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GRAZING

RESEARCH PROGRAM

1926

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RG
Climate & Plant Growth
G. B. E. S.

Project: The effect of climate on plant growth.

Scope: To determine (1) which of the more common climatic factors are of primary importance to forage growth, and (2) the part climate, and particularly fluctuations in climate from year to year play in (a) forage development and production, (b) the outcome of experimental work generally, and (3) the adjustments in management necessary to meet fluctuations in forage production.

Status: Records of various climatic factors have been obtained during the growing season and in some cases yearlong for most years since 1914. These include air temperature and precipitation during growing season continuous since 1914, and in some cases yearlong in three vegetative zones near the stations; soil moisture and temperature, evaporation, air humidity, sunshine intensity and duration, wind velocity and tipping bucket rain gauge in one to three zones during the growing season for most years since 1914. A technical study including the effect of climatic factors on growth of peas, wheat, and native bromegrass was made in 1916 and 1917 and reported on in Department of Agriculture Bulletin No. 700.

Beginning in 1924, a number of plots were established upon which growth and development of various forage species are recorded, and the rate of forage yield determined each season for correlation with moisture, air, soil temperature, and evaporation.

The phase of the study started in 1924 has not been thoroughly analyzed. However, it is apparent that in this region where there is heavy winter snowfall, temperature is the factor which chiefly influences beginning of growth and forage development in the spring. Growth begins immediately after the snow melts, but progresses very slowly until the temperature of the soil climbs to a favorable point, after which it continues as rapidly as favorable air temperatures will permit.

Moisture is the chief factor affecting the amount of forage produced. In 1924, when the previous winter precipitation was deficient, when June was dry, and although July, August, and September precipitation was almost up to average, the yield on the correlation plots was 19 per cent below that of 1923, 33 per cent below the average annual yield since 1920 prior to 1924, and 29 per cent below the average annual yield since 1920, including 1924. In 1925, when previous winter precipitation was about average, when June was the wettest June since records were started, and July, August, and September

precipitation was only slightly above average, the forage yield was the greatest since records were started, being 64 per cent above 1924, 15 per cent above the average yield previous to 1925, and 7 per cent above the average yield including 1925. It is apparent, therefore, that distribution of the moisture, especially winter snows and precipitation during June are the chief factors influencing the amount of forage produced.

Plans: Record taking and accumulation of data as started in 1924 will be continued. Compilation of data obtained will be continued during the winter with the view of attempting to correlate heat units or temperature indices in the spring with vegetative readiness and to determine the amount and distribution of moisture essential to an average forage crop. The project should reach a point where a progress report may be prepared during the winter of 1926-27.

Assignment: C. L. Forsling and E. W. Nelson, Great Basin Experiment Station. The U. S. Weather Bureau cooperates in obtaining meteorological data.

RG
Artificial Reseeding
(Tame Species)
G.B.E.S.

Project: Artificial reseeding of depleted range lands to tame forage species.

Scope: To determine: (1) suitable species, (2) site conditions, (3) methods and time of seeding, (4) methods of grazing during period of establishment, and (5) economics of improving depleted range by introduction of tame (cultivated) forage species on mountain ranges where the annual rainfall is from 20 to 30 inches, and where the growing season is 100 to 120 days in length.

Status: A number of tame forage species have been tried out under various conditions of soil, moisture, time of seeding, and treatment. These trials indicate that artificial reseeding of tame species is practical and economical only on range of exceptionally potential high value where there is little hope of natural revegetation within 15 to 20 years, and where moisture conditions are above the average.

The creeping grasses such as Kentucky and Canada bluegrasses, and smooth brome give the best results under the foregoing conditions but are slow to become established. Bunchgrasses such as timothy and orchard grass, require seed for reproduction, but seed will seldom be matured where the growing season is short. In view of early establishment after seeding and low cost of seed, the latter species are of some value for range reseeding.

Sowing should be done at a time so that seasonal drought will do the minimum injury to young seedlings. Fall sowing generally gives the best results, in regions where there is a heavy accumulation of winter snow.

Trampling the seed in with stock appears to be the most economical and practical method of getting the seed into the ground.

Grazing should be deferred until late in the season each year until the crop sown has become well established.

Plans: No further work in this project will be undertaken at this time. As promising untried species come to our attention, they will be given a trial. Every opportunity will be made to check administrative projects of artificial reseeding of tame species.

Assignment: C. L. Forsling and E. W. Nelson, Great Basin Experiment Station.

RG
Artificial Reseeding
(Native Species)
G.B.E.S.

Project: Artificial reseeding of depleted range lands to native forage species.

Scope: To determine the suitability of various promising native range forage plants for artificial reseeding, including (1) the adaptability of species to produce seed, (2) planting practices.

Status: Native forage plants are already adapted to local growing conditions. Any of these species, therefore, that are susceptible to cultivation should prove of value for artificial reseeding purposes. A number of trials with various grasses and weeds prior to 1920 gave favorable results in the case of Agropyron violaceum and Bromus polyanthus. Either species should be suitable for artificial reseeding purposes where the rainfall exceeds 25 inches and is properly distributed. The main difficulty lies in obtaining a supply of seed although indications are that seed production would be economical and practical. Further work is necessary to substantiate this statement.

Seed of a number of grasses was received from various Forests in the Western District in the fall of 1924. Bromus marginatus, Aira caespitosa, and one of the Poas from D-2 germinated well when sowed in the fall, and it is believed good stands will become established. It was interesting to note that in 1925, plots sowed in the spring which were weeded and watered during a brief dry period in June, did not do as well as the unweeded, unwatered, check plots.

Plans: Native species will be tried out in the nursery and on the range as fast as seed is obtained and other conditions justify.

Assignment: C. L. Forsling and E. W. Nelson, Great Basin Experiment Station.

RG
Artificial Reseeding of
Range in Southwest

Object: To determine the species of forage plants, foreign or native, which are best adapted to grow under the varying conditions of elevation, temperature, soil, and precipitation existing on southwestern ranges; also to determine the species of trees best adapted to grow under the varying conditions encountered in south-central New Mexico for the purpose of providing a means of retarding the drifting of sand on depleted range areas and also for the purpose of providing windbreaks and shade trees.

Status: Tests of seeding slender grama, hairy grama, filaree, and Russian thistle on semi-desert range at the Jornada Range Reserve have shown negative results. Chinese elm, Chinese pistache, and evergreen athel were secured from the Bureau of Plant Industry and planted at the Reserve in 1923, and were watered regularly whenever the moisture conditions were not favorable to growth. Climatic conditions were severe in 1923 and 1924. By the fall of 1925 the elm had a survival of 10.3 per cent and had made an average annual growth of about 9 inches; the pistache a survival of 9.5 per cent but average annual growth was about 2 inches. One, or 5 per cent, of the athel was alive. All probably would have died if they had not been irrigated.

Early tests of several species of native plants on the Santa Rita Range Reserve proved uneconomic. The few plants of Phormium tenax, Kudzu vine (Pueraria thunbergiana), and Portulacaria afra which survived the extreme drought of the spring and early summer of 1923 on the Santa Rita Range Reserve died during 1924 from the cold of winter and the continued drought, even though they were watered artificially.

Experiments of cultivation of indigenous forage plants at the Fort Valley Experiment Station were made with 13 native species. Of these four show promising results, six have produced a thin stand, and three have been failures.

Future Work: Climatic conditions are generally unfavorable to the success of introduced plants, but efforts will be continued to find some hardy species which will be successful and increase the forage crop, or serve in erosion control. Whenever seeds or plants of promising species can be secured, tests will be made on the semi-desert ranges of both the Jornada and Santa Rita Range Reserves of other important plants introduced from the semi-desert regions of South Africa, China, and other countries. Tests will be made of Russian Mulberry at the Jornada and of desert willow at the Santa Rita.

Detailed data will be recorded as to germination, growth, survival, ability to withstand the adverse climatic conditions, and the ability to hold drifting sand and prevent other types of erosion.

It is planned to start work on the Jornada Reserve in cooperation with the Bureau of Public Roads and the New Mexico Agricultural College Experiment Station to determine the possibilities of flood irrigation for the production of emergency forage crops for supplemental feeding.

Date of Completion: Tests will be continued as promising species are available during the continuance of the investigations at the Jornada and Santa Rita Reserves.

Assignment: Matt J. Culley, Santa Rita Range Reserve; and J. D. Schoeller, Jornada Range Reserve in cooperation with District 3 and the Bureau of Plant Industry.

RG
Artificial Reseeding
D-6

Project: Artificial reseeding of burned-over and logged-off lands, D-6.

Object: To determine suitable species and methods for reseeding burned-over and logged-off lands in the Northwest.

Status: Results on the rather dry site on the Crater Forest show no practical basis for seeding under these conditions. Results of reseeding cut-over areas where rainfall is abundant show practical success.

Further Work: Work on Crater Forest closed. Further tests will be made as a sub-project of the "Grazing Management of Cut-over Areas" study at a future date.

Date of Completion: Indefinite.

Assignment: D. C. Ingram.

RG
Natural Revegetation,
Deferred and Rotation Grazing

Project: Application of the "deferred" and the "deferred and rotation" systems of grazing.

Status: The deferred and rotation grazing system was developed in the Blue Mountain region of Oregon and the results published in Department Bulletin No. 34, the Journal of Agricultural Research, Yearbook, and several other articles. This project is more a line of work than an investigation, determining for specific conditions the possibilities of application of deferred grazing or deferred and rotation grazing, and the adjustments necessary from the theoretical plan.

To secure satisfactory application and the best results it is essential that Forest officers and stockmen understand the fundamentals underlying the systems and the other phases of good range management which must go hand in hand with deferred and rotation grazing.

These systems are now in application on many ranges, especially in Montana and Utah, with benefit both to range and stock. Their wider application, however, is progressing as fast as the stockmen are brought to realize their value and the necessary adjustments, if any, determined for the local conditions.

Further Work: Study of the need for and possibilities of application will be continued on those areas where grazing use demands such intensive management methods.

Date of Completion: Indefinite. A line of work.

Assignment: All Forest officers charged with the administration of grazing.

RG
Natural Revegetation
G.B.E.S.

Project: Range improvement and maintenance by natural revegetation of native forage species.

Scope: To determine (1) the most expedient and economical methods of natural revegetation of native forage plants, (2) the rate of improvement on depleted range lands, and (3) methods of management of livestock on the range to meet the requirements of natural revegetation.

Status: Results of early work published in various bulletins and reports including Department Bul. 34, 790, 791 and 1405. The last is now in course of publication. The work is being continued with various classes of forage on ranges in various stages of depletion and under different systems of handling livestock including sheep under deferred and rotation grazing on common use range and exclusive sheep range, more or less controlled season long grazing by cattle, and on ungrazed plots. Most of the plots show improvement under the different methods of handling in the order of (1) total protection, (2) deferred grazing on exclusive sheep range, (3) more or less controlled season long grazing of cattle. Areas where proper seasonal use by cattle has been applied the past season show tremendous improvement in one year. On a cattle range on the Manti Forest there was very little change in numbers of livestock from 1907 to 1923, except to eliminate some trespass, but the opening date was advanced about three weeks in the spring. In 1923 and 1924 about 1/2 the cattle were changed to sheep on a 1 to 2½ head basis. Marked improvement is being shown in the range especially at the higher elevations at the present time. There has been slow but steady progress for a great many years, but now with the final establishment of some valuable species on the area the improvement curve is shooting upward much more rapidly than for a number of years in the past.

The study was extended in 1925 to obtain more comprehensive data on browse forage including bitterbrush, birchleaf mahogany, snowberry, oak and serviceberry.

Plans: Mapping of plots and quadrats and remeasurement of browse plants as needed will be done in 1926. The project will be continued until eventually all of the important types and conditions available for study in the vicinity of the Station will be covered.

Assignment: C. L. Forsling and E. W. Nelson, Great Basin Experiment Station.

RG
Natural Revegetation
Plant Vigor
G.B.E.S.

Project: The relation of season, frequency and degree of harvesting to the productivity, revegetation and vigor of the vegetation.

Object: To determine the effect on vigor, revegetation and productivity of harvesting at different seasons, intervals, and closeness of cropping on important forage species and to work out methods of grazing based on the results to improve and maintain the range, and at the same time obtain the best use of the forage.

Status: The main results of the early work covering the project up to 1922 inclusive involving 11 species and 26 methods of harvesting, is in course of publication as Department bulletin 1405. The results show that too frequent harvesting of bunch grasses and weeds, such as at monthly intervals is too severe, resulting in prevention of revegetation, in decreasing the amount of forage produced, and in lowering the vitality of the forage plants. Two grazings - one very light grazing in the spring after vegetative readiness and another grazing after the seed production stage will probably result in the maximum yield without injuring the vitality of the plants, but unless delayed until after seed maturity (which is delayed by the early grazing) revegetation of other than creeping plants will be interfered with.

The project was revised in 1923 to study more critically some of the methods previously tried out, on a plot rather than individual plant basis. In the same year it was extended to a pasture basis. Three pastures are available, one of which is grazed at time of vegetative readiness and again at time of seed maturity, another at vegetative readiness, at seed maturity, and again in the fall before the close of the grazing season. A third is grazed at time of seed maturity and again near the end of the grazing season. A number of hurdles are provided which makes possible three additional systems of grazing. This phase of the project is in its third year.

Plans: The three years results of the pasture trial will be worked up this winter. The project as a whole will be continued through 1926, as in 1923, 1924, and 1925.

As soon as arrangements can be made, it is planned to try out several methods under actual range conditions.

Assignment: C. L. Forsling and E. W. Nelson, Great Basin Experiment Station.

RG
Natural Revegetation
Utilization
G.B.E.S.

Project: The proper degree of utilization of range lands.

Scope: To determine (1) proper degree of utilization in the fall, (2) time when grazing should be discontinued in the fall, (3) standards for judging utilization, and (4) percentage of good forage which should remain at time of seed maturity each year on ranges where deferred and rotation grazing is not applied to improve or maintain the forage stand.

Status: A pasture for this project was built in 1923, and the study gotten under way in 1925. A small herd of steers were grazed in the pasture beginning July 12. Plots and quadrats established last year were handled in different ways. On two, grazing was deferred until seed maturity, and on 5 others, grazing was excluded for certain periods or when a certain degree of utilization had been reached, by use of the hurdle enclosure. The project has not been under way for a sufficient length of time to afford any results.

An interesting side light was the use of tall larkspur, ordinarily considered very dangerous, by the steers in the pasture. About 1/8 of the area is occupied by dense stands of tall larkspur. After the 29 steers had been in the pasture about two weeks they began to eat the plant to some extent. This use increased until approximately 60% of the larkspur in the pasture had been eaten by the time the steers were removed late in August. Yet there were no losses attributed to poison. One steer died, but from all indications the loss was due to disease. The fact that there was other feed to begin with and that the steers began to eat a very small amount of larkspur, and then increased the amount slowly until they became accustomed to it, is believed to account for the lack of losses.

Plans: Project will be continued with grazing of pasture, adjustment of hurdles and recharting of quadrats in 1926.

Assignment: C. L. Forsling and E. W. Nelson, Great Basin Experiment Station.

RG
Natural Revegetation
(Biological Study of
Plant Succession)
G.B.E.S.

Object: (1) To develop certain field tests based on the character of the soil by which the suitability of the soil to support the various stages in plant succession may be predicted with a high degree of accuracy, and (2) to ascertain the relationship of osmotic concentration, certain salts and electric conductivity of cell sap of various range plants to (a) their position in the successional scale and (b) palatability and forage value.

Status: The working plan was prepared in 1919. Very little work has been done, owing to insufficient funds and personnel. Three weeks in 1921 were spent in determining the osmotic concentrations of some of the indicator species and a few days of similar work in 1924. In 1925 Dr. J. Arthur Harris of the University of Minnesota assigned Miss Harriett George to the Station and a considerable number of osmotic concentrations were determined for the more important species.

Further Work: Fulfillment of the proposed plan of this project cannot be realized until the Station funds and personnel are increased. A limited amount of time will continue to be devoted to the study of osmotic concentration, chemical composition and electrical conductivity of the cell sap of some of the more significant plants in the vicinity of the Station, and to correlate these data with site, type, palatability, etc., in cooperation with Dr. Harris of the University of Minnesota.

Use of Results: The working out of this problem should go far to determine (1) the potential value of range areas, (2) management necessary to stimulate succession in the way desired, (3) the length of time required for complete revegetation, (4) the use of the cell sap method in revegetation studies in range investigations, (5) the relation of sap concentrations to palatability.

Date of Completion: Three years after work is actively undertaken.

Assignment: C. L. Forsling, Great Basin Experiment Station, in cooperation with Dr. J. Arthur Harris of the University of Minnesota.

RG
Natural Revegetation
Spring-Fall Range
U.S.S.R.S.

Project: Requirements for natural revegetation to maintain and improve spring-fall range.

Scope: To determine for spring-fall range, the details in the application of the deferred and rotation system of grazing, involving (1) the rate of improvement of depleted range under the system; (2) the frequency with which grazing should be deferred to maintain range in good condition; and (3) to determine the trend of plant succession and the plant indicators of range conditions.

Status: Three eighty-acre paddocks (Nos. 1, 6, and Ram Pasture) are grazed in the fall only during alternate years, and lightly during the spring and again in the fall respectively. Major plots and quadrats have been established in each paddock and within totally protected areas. The major plots were re-listed in 1925. Daily records of use are being maintained for paddocks 1 and 6, and an intensive reconnaissance has been made for each area.

Plans: The three years' records will be compiled during the winter and a progress report prepared. A check-up will be made to determine whether or not deferred grazing should be continued in paddock No. 1. Quadrats which were charted in 1923 will be re-mapped in 1926.

Assignment: C. L. Forsling, Great Basin Experiment Station, in cooperation with W. A. Denecke, U. S. Sheep Experiment Station.

RG
Natural Revegetation
Utilization
Spring-Fall Range
U.S.S.E.S.

Project: The degree of utilization of spring-fall range.

Scope: To determine for spring-fall range (1) the degree of grazing that may be permitted in the spring and in the fall without injury to the forage and to have an adequate amount of forage available for use during both the spring and fall seasons, and (2) the effect of time and degree of use upon pasture gains of sheep.

Status: The grazing of Paddock 7, at the U. S. Sheep Experiment Station,, which provides for light spring use and heavy fall use, and of Paddocks 2 and 8 which provide for fairly heavy spring use, is designed to give information as to the effect of closeness of use in the fall and spring. The results from grazing of Paddocks 2, 3, 6, and 8, will show the extent to which growth following the spring grazing season can be depended upon for use in the fall, or if it will be necessary to restrict grazing in the spring to provide a supply of forage for fall use in the average year. Major plot and quadrat records are being maintained, together with records of utilization at various times of the year, and gains of sheep during the fall for each of the paddocks. During 1924, the summer of which was very dry, it was found that very little forage was produced after the spring grazing season, and sheep were forced to subsist on spring growth for fall feed, with the exception of some green forage which was produced by fall rains. Comparison of entrance and leaving weights of the sheep grazed in the paddocks during the fall period, and paddocks which have received varying degrees of use in the spring, will furnish data with regard to the kind and character of feed on which sheep will tend to hold up best during the fall season.

Plans: The paddock will be grazed in much the same manner in 1926 as in the past three seasons. Weights will be secured and record of utilization for 1926 will be obtained as in the past two years. The quadrats in each of the paddocks will be re-mapped in 1926.

Assignment: C. L. Forsling, Great Basin Experiment Station, in cooperation with W. A. Denecke, U. S. Sheep Experiment Station.

RG
Natural Revegetation,
Santa Rita

Project: 1. To determine the possibility of improving the range by natural revegetation; 2. to determine the influence of grazing use upon natural revegetation; 3, to determine the influence of climatic conditions (particularly rainfall) upon natural revegetation; 4, to determine the influence of both grazing and climatic conditions upon height growth.

Status: 1. Extensive study has been made of this phase of the project and the results point conclusively to the fact that range improvement can be brought about by natural revegetation and furthermore that it is the most practical and economical means of bringing about such improvement.

2. The influence of grazing use has been a difficult one to determine. Most of the work has been based on a study of approximately one hundred and fifty quadrats located all over the Reserve and subjected to varying degrees of grazing use. Due to the difficulty of closely following the exact use of these the variation in response to grazing has not been as pronounced as might be desirable. However, the results have been very much emphasized by more detailed studies conducted during the past four years so that the conclusions reached are sufficiently definite to serve as a guide in managing the types of range concerned. It is also felt that the basic principles may be applied quite generally over the Southwest, with modifications to meet local conditions.

Present conclusions are as follows: (a) that while not exerting the most important influence grazing use does materially affect natural revegetation of the range, (b) that, generally speaking, the response through natural revegetation varies inversely as the intensity of use increases. The outstanding exception to this rule is Rothrock's grama which grows best under full use (not overgrazing) and apparently loses ground under light use, (c) that conservative use of a range is primarily essential for natural revegetation, (d) that revegetation of depleted ranges can be brought about just as effectively by properly controlled grazing use as by total protection. In the case of Rothrock's grama range, controlled grazing use is decidedly more effective than total protection, (e) that total protection will result in improvement of the range up to approximately three years unless badly depleted when continued improvement will occur. Continued protection from that time on will result in a very rapid decline of good species with a corresponding increase of plants low in forage value, (f) that properly controlled grazing use maintains a better balance between plant growth and available plant food in the soil which results in a higher average stand over a period of years.

3. The influence of climatic conditions of which rainfall is most important in this region, is the primarily deciding factor in bringing about natural revegetation over a period of years. The principal conclusions in this study are: (a) that the total amount of rainfall does not necessarily govern the rate of natural revegetation there being a very important influence in seasonal distribution and character, (b) that summer rains are by far the most important although their final effectiveness is governed to a very great extent by the amount of winter and spring rains, (c) that early summer rains are ordinarily the most effective, (d) that continued light showers, even though the aggregate amount is equal to one or two heavy rains, are much less effective than the latter, (e) that the vegetation does not ordinarily respond to rainfall or lack of it until the following year. (Rothrock's grama here proves an exception in that it responds immediately to rainfall or drought in much the same manner as annual growth).

4. Conclusions on the height growth subproject are as follows: (a) that growth on grazed areas starts from two to three weeks later than on totally protected range, (b) that height growth on grazed areas is less than that on totally protected, (c) that over a period of years the volume of feed produced on grazed ranges will exceed that produced on totally protected ones due to the greater average density of the former, (see natural revegetation), (d) that rainfall is easily the controlling factor in height growth, (e) that a few heavy rains early in the season are much more beneficial than continued light showers.

Further Work: All the phases of this study will be continued. It is planned, however, to chart many of the permanent quadrats only once every two or three years or perhaps at longer intervals. This practice will permit of more detailed work on recently initiated period study quadrats and it is believed that the latter will make possible a more definite determination of the effect of grazing use and climatic conditions. Conduct of the work on this basis will mean a material saving in time since the period study projects are much more concentrated and controlling factors can be much more readily determined.

Date of Completion: Indefinite.

Assignment: Matt J. Culley, and Warren S. Turner, Santa Rita Range Reserve.

RG
Natural Revegetation
Jornada

Status: A comparative study has been made for ten years of results secured under yearlong grazing, summer use only, deferred grazing, and total protection on the Reserve and on adjoining public domain range where grazing is unregulated. Detailed observations have been made of methods of reproduction of the important forage species and a number of large quadrats were established and clipped beginning in 1920 to determine the effect of various degrees of cropping at various times of the year. A study of growth habits and degrees of grazing upon blue and hairy grama grass was initiated in 1921. General studies of the life history, rate of growth, reproduction, methods of cutting, etc., of soapweed production were started in 1918. A more detailed study of soapweed growth was started in 1925. Results obtained up to 1917 were published in Bulletin 588, and those up to 1920 in Bulletin 1031. Progress reports have been submitted each year since.

During the past eleven years six have been below normal and only two materially above. 1924 concluded the fourth successive dry year and proved to be the worst since 1917. Growth, particularly on the grama type, was very scant. Where grazing was partially deferred during the main grazing season, depreciation on grazed range was least during drought and best results have been secured in recovering and maintaining productivity.

No cattle were on the Reserve during the summer growing period of 1925. Though rainfall was below normal growth was good on most range types. The grama and Aristida types show a remarkable recovery from the drought conditions of the last three years.

Further Work: The detailed quadrat studies will be continued. Careful observations for the area as a whole will be made to supplement the detailed data secured from the chartings. The studies will be extended and strer_thened by the establishment of additional quadrats and additional small protected areas. The further recovery of the different types of vegetation from the detrimental effects of the drought will be carefully studied. The observations to determine more accurately the particular ways in which the forage plants reproduce will be further extended.

Through a close correlation of all phases of the problem the rate of recovery of depleted ranges and maintenance of normal carrying capacity under the different methods of range management will be determined.

Date of Completion: Indefinite.

Assignment: J. D. Schoeller, Robert S. Campbell and Roy Canfield, Jornada Range Reserve.

RG
Natural Revegetation,
Snakeweed,
Jornada

Object: To determine reasons for snakeweed (Gutierrezia sarothrae) invasion of the black grama type, its possible value in the type, and the effect of competition of snakeweed and black grama.

Status: Plots established in 1924, root systems studied in 1925, careful observations made on all phases of project.

Drought and overgrazing play important parts in increase of snakeweed on the black grama type. Many snakeweed seedlings have come in the last two years on range where the black grama stand has been thinned to below 2/10 density. It was rather difficult to find healthy snakeweed plants on areas where the grama occurred in a good stand and made a good growth. Under such conditions there is considerable intermingling of grama roots 4 to 5 inches beneath the soil surface. On numerous areas the snakeweed is dying. Beetles, Cerambycids of the genus Crossidius and decay have attacked the roots of most plants over 12 inches high. While grama root systems average about 8 inches in depth and seldom reach 12 inches, snakeweed seedlings averaging 4 inches in height had tap roots of 17 inches. Root systems of larger plants averaged 24 inches in depth. On badly depleted sandy areas snakeweed tends to reduce wind erosion.

During 1925 there was a considerable decrease in both the number of snakeweed specimens and in the density of the snakeweed stand. Old plants in particular were affected. On two of the areas there was a decrease and on one an increase in black grama.

Further Work: Will be continued along same lines.

Date of Completion: When conclusive data have been secured.

Assignment: J. D. Schoeller, Jornada Range Reserve.

RG
Natural Revegetation,
D-1

Object: To determine what method or methods, system or systems, and intensity of grazing will maintain the vegetation of the Northern Rocky Mountains in the highest state of productivity or will increase the stand if depleted; to study growth habits and requirements of principal species.

Status: This project has been carried in the past largely as an administrative project to secure the application of principles developed in other places to the Northern Rocky Mountain conditions. In 1924 active work was undertaken on the Madison National Forest, Montana, to determine fundamental data relating to the habits of growth, seeding, longevity, and life history of the principal forage species. This work is closely connected with the other studies on the Madison and the same set of quadrats, transects and enclosures are used. In 1925 observations were also made to determine if possible the correlation of natural revegetation and soil types.

Further Work: The quadrats will be recharted and observations will be made on individual plants as well as on general types. It is also proposed to make a study of plant succession under natural conditions as well as in habitats where grazing is an important ecological factor. In so far as possible tests will be made of the principles evolved.

The results obtained will be a basis for the determination of what constitutes satisfactory range conditions and proper methods of management. With these data available the condition of a range can be accurately judged and the point of highest productivity determined.

Date of Completion: The work will be continued on the Madison for another year and then it may be transferred to some other Forest. The study of natural revegetation will be continuous.

Assignment: W. G. McGinnies in cooperation with local Forest officers.

RG
Natural Revegetation,
D-2

Status: A project was initiated to determine the influence of deferred and rotation grazing on cattle ranges on the Medicine Bow Forest in 1914. Two compartments were fenced; one was grazed season long by cattle, and the other only after seed maturity for the first two years; then the order was reversed for the next two years and this system of rotation has been continued each two years since. During the first three years there was only a slight increase in amount of surface covered by fescue and bluegrass and no increase in other vegetation. Since 1916 there has been a marked increase in all the vegetation, especially grasses and sedges. Results indicate that during the first few years the benefit to the range which resulted lay in recovery of the vitality of the plants and that this increase in vitality was necessary before the marked increase in stand could take place.

Each Forest in the District (except Nebraska and the Lake States) has been required to establish at least five fenced plots with chart quadrats inside and outside. On a few Forests more than the five were established. These plots will be used to study the development of the vegetation and its maintenance under the management being applied to the range. The benefit of this work is largely in indicating definite need for change of management, where retrogression in the stand or slow recuperation of depleted areas is indicated.

Further Work: It is planned to continue the observations and rechart the quadrats at intervals of two to five years to determine more definitely the trend of vegetation in this region under total protection, deferred and rotation grazing, and other types of management. The ultimate objective is to have one such plot in each major type of range on each ranger district.

Date of Completion: Indefinite.

Assignment: Forest officers of the District in cooperation with L. H. Douglas.

RG
Natural Revegetation
D-3

Object: To determine proper methods for handling the various southwestern forage types on a sustained production basis. More definite knowledge is especially needed concerning such fundamental principles as:

(1) Normal forage composition of various sites.

(2) Plant changes due to varying intensities and methods of grazing compared to protection.

(3) Density changes due to overgrazing.

(4) Rate of recovery of abused ranges.

Status: Five plots about 2 acres in size on the Coconino Forest in mixed bunchgrass and grama types were fenced in 1912. Five-metre quadrats were established within each area and five on adjacent range outside. All quadrats charted in 1912, 1913, 1914, 1921, 1924, and 1925 - a few in 1917. Progress reports by Talbot in 1923 and Nelson, 1925. The following chief indications were noted: Grama under protection declines in stand with competition of ungrazed bunchgrasses, maintains its stand under light to full grazing use and may even gain under latter, but succombs to long-continued overgrazing. Bunchgrasses gained under light grazing or total protection, but lost under full use of the type and decidedly under overgrazing. Black Sporobolus resisted overgrazing the best of any species studied. "Weeds" and minor grasses exhibited varied behavior by species. In one instance total density of all vegetation increased more under light grazing than under total protection.

The 1924 records were taken during a drought and show that drought may cause a reduction of from 40 to 60 per cent of the range forage crop even on protected areas. This is the combined result of killing of parts of tufts and of decreased vegetative growth. The reduction in density increases as the degree of grazing increases. Blue grama made very little vegetative growth. Weed growth was not so seriously affected.

The Tonto investigations are reported under the "Utilization and Management of Browse Range, D-3" project.

A mimeographed report, "How to Judge Southwestern Range Conditions" by M. W. Talbot was prepared and sent to the field.

Further Work: The Coconino plots will be charted at intervals, and work will be continued on the browse types in connection with the study of the utilization and management of browse range.

Assignment: C. K. Cooperrider, and R. F. Copple.

RG
Natural Revegetation
D-4

Object: To determine time and methods necessary to naturally revegetate badly depleted ranges of the National Forests of the Intermountain region, and to determine methods necessary to maintain desirable forage stand once secured.

Status: In 1915 work was started on the Humboldt Forest in northern Nevada, in 1917 on the sagebrush-browse ranges of the Cache Forest in northern Utah, in 1923 on cattle ranges and in 1924 on range used in common by cattle and sheep on the Uinta. The past quadrat and other work on the study was checked up in the field during 1924 and 1925. Such new plots were established and observations undertaken as will give a basis for solving the main questions of improvement and maintenance of the important range types on the Forests of the intermountain region.

Date of Completion: Indefinite.

Assignment: J. O. Stewart and administrative officers on the respective Forests of District 4.

RG

Economic Importance, Distribution, and Natural Habits of Range Plants, D-1 to D-8

Object: Collection and analysis of economic, ecological, phenological, and other data on growth and growth requirements of National Forest range plants, together with the development of workable herbaria of these plants with their data.

Status: The proper use and management of any range area depends to a large extent upon knowledge of the forage value under different conditions, other economic significance, growth requirements, and life habits of the plants which make up the vegetative cover on that range.

Work started in 1907. Over 50,000 plants, largely in quadruplicate, and accompanying data have been collected in the field by upwards of 1,000 collectors, including grazing specialists, range reconnaissance parties, and administrative men on important grazing Forests. These specimens have been identified by the experts of the Bureau of Plant Industry. Between 85 and 90 per cent of the plants collected are represented in the Washington office herbarium, representing upwards of 6,000 species and varieties, belonging to over 1,000 genera.

Special observations on palatability, forage value, and other factors have been made at the Great Basin Experiment Station and on the Santa Rita and Jornada Range Reserves, and by qualified men assigned to Forests. Preliminary tables of palatability are being compiled by Forests and groups of Forests in each District. Manuscript analyses ("economic notes") are available for about 3,500 species and varieties.

Brief primers of the more common species have been worked up for Districts 3 and 4. A booklet containing notes for the grass species was printed in 1914, and Bulletin 545, ("Important Range Plants,") was published in 1918. A general bulletin on important western browse plants has been presented for publication. A revised and enlarged leaflet of instructions governing the collection and annotation of range plant specimens was issued during the year, as well as several technical papers in the botanical press. Manuscript is well under way for a general bulletin on "weeds," while a bulletin on southwestern range plants is in semi-final form. Mr. Tidestrom's Flora of Utah and Nevada, largely based on Forest Service collections, has issued from press and his manuscript Flora of Arizona is now about 75 per cent completed. The Forest Service has given assistance in connection with both these valuable floristic works.

Special effort is being made to have Rangers become familiar with the more important forage plants of their districts.

Further Work: Collections will be continued, special attention being paid to more thorough observations. Further compilation of palatability data will be made and lists revised as more data become available. Collection and analysis of economic and other data will be continued with the view of submitting the material for publication as rapidly and in such sequence as may seem desirable, and bulletins now under way will be pushed to completion.

Assignment: W. A. Dayton, Ivar Tidestrom, and grazing men in Districts, and at experiment station. Mr. Shoemaker is cooperating in the preparation of the general "weed" bulletin, and Mr. M. W. Talbot (now of the Bureau of Plant Industry) in the bulletin on southwestern range plants.

RG
Forage Analysis,
Santa Rita

Project: To determine chemical composition of important forage plants at different times during the growing season as well as later when the same species have cured.

Status: Some of the more important grasses were collected during 1921 and 1922 and the results embodied in previous reports. Briefly these showed no great difference in protein value as between species at any given time. The relative percentage drop in protein content as maturity approached and after was much the same for all species, except one or two which gave evidence of maintaining a higher protein value later into the dormant season than the general average. Black grama (B. eriopoda) was the most noticeable in this respect.

During 1925 extensive collections of important grass and browse species were secured and will be forwarded shortly to the U. S. Bureau of Chemistry for chemical analysis. It was planned to have this done at the University of Arizona but the department has been so fully occupied with other work of a similar nature that they are unable to handle our work in addition. The University is planning on conducting a series of digestive feeding tests with some of the more important grasses and should these materialize the results of our chemical analysis project will be important. For the present the results will serve as a basis for initiating such tests.

Further Work: Additional collections, of the same plants gathered in 1925, will be made during the coming field season.

Date of Completion: Indefinite.

Assignment: Matt J. Culley, Santa Rita Range Reserve.

RG
Period Studies,
D-1

Object: To determine for Northern Rocky Mountain conditions vegetative readiness, factors affecting first growth of vegetation, time necessary for species to make a good vigorous growth, influence of grazing before vegetative readiness, factors that determine the proper closing of the season and the effect of cropping second growth; management and handling of stock on the spring ranges.

Status: Temporary enclosures were erected in 1925 on the Madison National Forest before stock was admitted and opened to grazing at eight-day intervals. Quadrats were located within the enclosures and on the spring range. All the available climatological data for the region were assembled and studied and a general study of early growth especially in relation to climate and other growing conditions was made. A weather station with maximum and minimum thermometers and rain gauge was established. Administrative study of early growth on representative areas was made on the Helena Forest in 1924 and on the Custer in 1925.

Further Work: Work will be continued along the same lines as followed the past year. Administrative studies to determine proper seasons of use in accordance with the principles developed will be made on all Forests as fast as available time will allow.

Date of Completion: Indefinite.

Assignment: W. G. McGinnies and administrative officers of the District.

RG
Period Studies,
D-2 to 6.

Project: Determination of date when grazing may be allowed upon each range unit without injury to range or livestock.

Object: To correlate opening of grazing season on each vegetational zone and type and management of livestock with time of vegetative readiness of range for grazing.

Status: Much still remains to be done in the way of phenological observations on each Forest for correlating these data with seasons of growth and proper time of use. Study was made of the ranges on the Uinta Forest in 1919 and a management plan developed to secure proper time of admitting and distribution of stock. Studies have also been made on representative districts of most of the Forests in District 4, and necessary changes made in opening of the grazing season. Other special studies have been made on the Montezuma Forest in Colorado, the Crater, Umatilla, Ochoco, Fremont and Whitman Forests in Oregon, the Wenatchee Forest in Washington, California and Stanislaus Forests in California, and the Santa Fe Forest in New Mexico. Seasons have been adjusted to a proper basis on many other Forests. The date of opening at the boundary of the Forest is but one phase of the problem; proper distribution of stock with respect to various exposures and elevations is of equal importance.

Further Work: Observations to determine the date of vegetative readiness of the range at various elevations and on different exposures and methods to secure proper management of livestock in accordance therewith will be extended to other Forests in all Districts, and will be continued until time of grazing and time of vegetative readiness of range for grazing have been correlated upon all the Forest ranges. This is a line of work rather than a specific project and is essential to proper range management.

Assignment: Inspectors of grazing, grazing examiners, and all Forest officers administering grazing in Districts.

RG
Period Study
G.B.E.S.

Project: Range readiness and the length of the grazing season on mountain grazing lands.

Scope: To determine (1) the effect of continued early use on the vigor and production of range forage plants, (2) the time at which stock may be admitted to the range without injury to the forage from too early use, (3) methods of determining the time of range readiness, (4) the effect of close cropping of the vegetation in the fall after seed maturity, and (5) the time that grazing should be discontinued in the fall.

Status: Results prior to 1923 setting forth effect of early cutting on subsequent production during the year, the stage of development that will withstand moderate grazing and a method of judging range readiness on the basis of the development of different groups of plants, and handling stock on the range in accordance with proper seasonal use, are in course of publication in Department bulletin 1405 by Sampson and Malmsten.

Checks are now being made on the variation in the date of readiness from year to year, the effect of continued early cropping one year after another, and the effect of different dates of discontinuing utilization in the fall. Groups of plants of Agropyron violaceum, Poa nevadensis, and Geranium viscosissimum were allowed to grow unmolested until seed maturity each year and were then harvested after which one group of each species was recut at 10-day intervals, another at 15-day intervals and another 20 days after the seed maturity cutting. Results are as follows:

Method and Plot No.		Yield in Grasses by Years per Plant				
		1921	1922	1923	1924	1925
Cut at 10-day intervals	Agropyron v. R 1-15	25.280 (100)	11.230 (44.4)	9.732 (38.5)	5.07 (20.17)	7.825 (31.0)
	Poa nev. P 1-15	6.556 (100)	4.013 (61.27)	2.438 (31.27)	.936 (14.37)	.493 (7.5)
	Geranium vis. Q 1-15	22.279 (100)	23.743 (106.6)	24.059 (108.0)	16.57 (74.4)	22.71 (101.9)
Cut at 15-day intervals	Agropyron v. R 16-30	21.123 (100)	14.602 (69.1)	10.823 (51.2)	4.82 (22.8)	11.733 (55.5)
	Poa nev. P 16-30	10.581 (100)	4.795 (45.3)	3.427 (32.4)	1.86 (17.6)	1.18 (11.2)
Cut at 20-day intervals	Agropyron v. R 31-45	20.259 (100)	12.414 (61.3)	7.733 (38.2)	4.46 (22.0)	4.88 (24.1)
	Poa nev. P 31-45	13.630 (100)	4.703 (34.5)	3.469 (25.5)	.807 (5.9)	.327 (24)
	Geranium vis. Q 16-30	24.481 (100)	23.207 (94.4)	25.998 (106.2)	21.10 (86.2)	26.48 (108.2)

Note: Figures in parenthesis are on the basis of yield in first year being equal to 100.

A number of plants of the more important species in each of the zones have been marked and records of development from beginning of growth through the season will be obtained for a number of years, beginning in 1925.

Plans: Cutting of plots to determine effect of continued early use, and close use late in the fall, and the record on variation in the date of range readiness will be continued.

Assignment: C. L. Forsling and E. W. Nelson, Great Basin Experiment Station.

RG
Period Study
Spring-fall Range
U.S.S.E.S.

Project: Range readiness on spring-fall range.

Scope: To determine for spring-fall range (1) the effect of continued early use on the production of forage; (2) the time at which grazing may begin in the spring without injury to the range from too early use; and (3) standards for judging the time of range readiness.

Status: The grazing of Paddock 2, which provides for use in the spring as soon as forage begins to grow, and use throughout the spring and fall seasons; Paddock 3, where grazing begins as early as any forage is produced in the spring and continues heavy for twenty to twenty-four days, and then is discontinued until fall, and Paddock 8, where grazing starts in the spring when the forage is about six inches high, and is continued the remainder of the spring and through the fall period, are designed to give information on this project.

Major plots and meter quadrats have been established in each paddock, and records of time of use and number of stock, and degree of utilization in the fall, are being maintained. The major plots were remapped in 1925.

After three years of use, as outlined above, Paddock 2 shows the injurious effects of too early grazing although this paddock has carried a slightly higher number of stock as compared with the others. Paddock 3 appears to show no bad effects thus far from very early use which was discontinued before the end of the spring growing period and there appears to be no injury from too early grazing in Paddock 8, where spring use is deferred until the forage has attained six inches of growth.

Plans: Grazing of these three paddocks will be continued through 1926, as in the past three seasons. The quadrats will be re-charted in 1926. Records of the development of the vegetation at time of vegetative readiness also should be obtained in 1926. Beginning in 1926, another system should be added, which provides for grazing beginning shortly after the inception of growth in the spring and continued through the season in one year followed in the succeeding year by grazing restricted until after the date of vegetative readiness.

Assignment: C. L. Forsling, Great Basin Experiment Station, in cooperation with W. A. Denecke, U. S. Sheep Experiment Station.

RG
Period Studies
Santa Rita

Project: To determine: 1. Periods when damage may result from grazing and the proper system of grazing use to apply in each type; 2. The extent to which range in the various types may be used without injury to the vegetation; 3. The most effective system or time of using the semi-desert type of range in order to secure the greatest benefit from the annual growth that occurs in it.

Status: 1. A great deal of information has been secured on this project from detailed study of the pastures where different systems of grazing use were practiced. In 1922 an enclosure was erected at Box Station for securing additional data. By subdividing the enclosure and applying different seasons of grazing use to each division more detailed data has been possible with the added factor of eliminating any guess work as to the system of use such as is bound to occur over such a large area as a pasture. The essential conclusions reached are: (a) that a conservative use is the prime essential to the maintenance of all types; (b) that full use of most types of range too early in the growing season materially reduces the amount of forage produced the following year (from the clipping study results and general observations), (c) that the foothill type of range necessitates the application of a partially deferred system of use during at least the first month of the summer growing season; (d) that the mesa type (where Rothrock's grama is dominant) does best under a conservative yearlong system of grazing; (e) that local areas, in the mesa type, where black grama is dominant require partially deferred use, during the early summer at least, and this may be effectively secured on the Santa Rita Reserve by salting away from such areas; (f) that the semi-desert range can be used under any system of grazing use (except of course overgrazing) without injury to the vegetation.

2. The degree of use that may be attained at any season of the year is still in question and must undergo further study. Tentative conclusions are as follows: (a) that use to within an inch of the ground at any season of the year constitutes overgrazing which results in material reduction in both density and volume of forage produced (results of clipping study and general observations); (b) that grazing to within 2 to 2½ inches of the ground, by the close of the grazing year, constitutes approximately full utilization.

3. While the study of the best time for using the semi-desert type phase of the period study is partially covered under (1), it is being treated as a separate subproject since it involves a determination of means to use the type to the best grazing advantage rather than as a means of preventing damage to the vegetation in the type. Spring and summer would seem the proper time for heaviest use of this type so as to utilize the annual growth that lasts for a short time at best, during these seasons. Considerable further study of this type is necessary since it is a very essential type of range, when available, in connection with grass ranges.

Further Work: The project will be continued on a more intensive scale than in the past through the medium of a number of enclosures erected during the past year. One new enclosure in the foothill type will be constructed early in the summer. Providing funds permit additional check plots, in the form of panel enclosures, will be constructed in the vicinity of each large enclosure.

Date of Completion: Continuous.

Assignment: Matt J. Culley and Warren S. Turner, Santa Rita Range Reserve.

RG
Period Studies,
Jornada

Object: To determine the proper season or seasons of use, the factors affecting and the degree and intensity of use.

Status: The study of effect of utilization at different seasons with openable enclosures in the black grama type at the Jornada Range Reserve continued for three years.

The tentative indications with black grama are as follows:

(a) Early grazing in the summer growing season reduced the final number of flower stalks and forage production.

(b) The maximum number of flower stalks was produced during the first month of the growing season.

(c) Grazing during the growing period tends to increase the number of horizontal flower stalks.

(d) Opening an area to grazing 15 days after growth starts is apt to result in reducing the stand even though it is properly grazed.

(e) Later opening of the season up to the close of the growing period tends to favor an increase in stand if range is not overgrazed.

Eight quadrats were established in the tobosa type. One set of four were clipped at two inches above the ground and the other set at four inches. One quadrat in each set was clipped weekly, one biweekly, one monthly and the other at the close of the season.

Four quadrats were established in the black grama type and clipped to two inches above the ground, one every two weeks, one every four weeks, one every six weeks and the other only at the close of the growing season. The tentative indications from the first year's data are that the greater the interval between clipping, the greater the production per square decimeter of area. Frequent clipping however tended to stimulate flower stalk production and in the case of tobosa grass, turf area as well.

Further Work: An additional set of four quadrats will be established in the grama type. A series of six one-acre openable enclosures will be established in the black grama type to study the results from grazing starting at time of 30, 60, and 90 days after summer growth, and during winter and spring only.

Assignment: J. D. Schoeller, R. S. Campbell, and Roy Canfield, Jornada Range Reserve.

RG
Carrying Capacity
Santa Rita

Project: To determine the carrying capacity of various types of range in Southern Arizona when under fenced control.

Status: Pasture records showing the actual number of stock using the various Reserve pastures have been kept for the past ten years. These, combined with field observations on seasonal forage production, changes in forage density, utilization, have given the following figures for the various range types, in a rolling country, such as are found on the Reserve:

Semi-Desert Type: Chiefly a browse type of range with little other than annual grasses and weeds; 49 acres per cow yearlong. This type may be used on a yearlong basis or in order to take advantage of summer annual growth may be stocked heavier during that season without injury to the range. This type of range has been found to play an essential part on any range unit since the browse species have proven invaluable in the late spring and also during drouth periods when they have played a most important part in reducing losses of stock to a minimum.

Mesa Type: Chiefly a grass type though considerable browse is present also. Acreage requirement per cow yearlong is 23. Generally speaking this type of range can be used on a yearlong conservative basis though it seems best to provide for partial deferred summer use of areas where black grama (B. eriopeda) is dominant. This has been very successfully accomplished on the Reserve through the medium of salting during the summer on areas where no black grama occurs. Local areas of annual growth occur in this type and salting on these during the summer has proven a very effective means of fully utilizing this short-lived plant growth.

Foothill Type: Essentially a grass type though browse species are present in noticeable amounts. Acreage requirement per cow yearlong is 19 acres where yearlong conservative grazing is practiced. The most desirable use of this type of range involves deferred summer use and under this system it will support an animal to every 16 acres. The study of this type of range in particular will be continued in order to determine the degree of deferred summer use necessary to insure most effective growth of the important grass species. At the present time indications are that a 50% deferred use during the first month of the summer growing season results in the best growth being produced. (The summer growing season being ordinarily considered as July, August and first half of September.)

Further Work: The project will be continued as in the past with particular emphasis to be placed on further study of the foothill type of range. For the most part data on this phase of the project will be collected in connection with the period study project. Such data as has already been collected will be presented under that project. A more intensive study of the relative palatability of various forage species will be undertaken during the coming summer.

Date of Completion: Continuous.

Assignment: Matt J. Culley and Warren S. Turner, Santa Rita Range Reserve.

RG

Carrying Capacity,
Jornada

Project: To determine carrying capacity of semi-arid range in southern New Mexico and the influence of the many factors affecting it.

Status: Records of the time of grazing and animal days feed furnished by each of 13 pastures on the Jornada Range Reserve have been kept for 9 to 12 years. The greater part of the area has been classified into range types, so as to determine carrying capacity as a whole for the Reserve and carrying capacity by large range types. A check reconnaissance was made in 1924. Especially the comparative carrying capacity of range under fenced control and under different methods of proper range management, and range not under fence, is being studied. Data for 3 years were published in Bulletin 588, and for 7 years in Bulletin 1031.

The droughts of 1916 to 1918 and 1921 to 1924 on the Jornada, have shown the real significance of drought as a factor in carrying capacity over a period of years. The reduction in carrying capacity as compared to good years may be as great as 50 per cent over extensive areas, and even greater in small types, due to drought alone. The investigations have clearly demonstrated that overstocking in connection with drought causes considerably greater reduction in the carrying capacity of the range. The range within the Reserve, properly stocked and handled under proper management methods, (the number of stock on the Jornada was reduced one-half from stocking in good years), has carried more stock through the series of years than unregulated range outside, and is now in better condition to carry a greater number on an equal area than the outside ranges.

Further Work: The data for the years 1916 to 1925 inclusive will be analyzed with a view to preparation of a report. With restocking of the Reserve the records will be kept for the new pastures.

Date of Completion: Indefinite.

Assignment: J. D. Schoeller, Jornada Range Reserve.

RG
Carrying Capacity,
D-1

Object: To determine forage-acre requirement for cattle and sheep; factors influencing carrying capacity and forage-acre allowance; proper utilization; amount of use of range consistent with perpetuation of important forage species; the degree of utilization which should be obtained under different systems or methods of management and the relative palatability of important species under all conditions.

Status: Early work on carrying capacity of sheep range on Deerlodge and Madison Forests., Quadrats established on Ford Creek area, Lewis-Clark in 1918, recharted in 1924, and results of study checked. Quadrats located on Madison Forest in 1915 rechecked. Additional ones established in 1924, and 1925 and series of temporary and permanent enclosures constructed. Observations on utilization and palatability made. A range reconnaissance of the experimental areas was made in 1925. A pasture comprising 4,292 acres on the Custer National Forest was covered by intensive reconnaissance in 1924. Enclosures and quadrats established in 1925 and the necessary utilization and other data recorded.

The general survey of the grazing situation on the western Montana and northern Idaho Forests started by Supervisor A. A. Simpson during 1924 was continued by E. D. Sandvig in 1925. Detailed study started in 1925 on Clearwater, Selway, St. Joe and Cabinet Forests.

Further Work: The work will be continued in a very thorough manner on the Madison. The work will be extended to other Forests to cover all main vegetational types as fast as the personnel can handle the work and funds become available.

Date of Completion: The work on the Madison will probably be completed in 1926, but the charting of a small number of typical quadrats and general rechecking of results may be continued at intervals of several years. On other Forests indefinite.

Assignment: W. G. McGinnies (Madison), E. D. Sandvig (Burned and logged areas in western part of District), T. Lommasson and Flathers (Custer); technical and other properly qualified grazing men assigned to District office and Forests.

RG
Carrying Capacity,
D-4

Status: From 1913 to 1916 a number of sheep ranges on the Targhee and Caribou Forests of Idaho and the Manti and Fishlake of Utah were studied. More recently work has been undertaken especially on cattle range on the Wasatch, Fishlake and Powell Forests of Utah, the Humboldt in Nevada and the Minidoka in Idaho. The study on the Wasatch is more intensive than the others. Records are kept on development and condition of the vegetation, the number of livestock and the period they graze each area, the yearly changes in vegetation and on factors affecting use with a view to determining forage acre requirements on each important forage type for cattle and sheep separately and when grazed in common.

Further Work: Work will be continued as outlined above.

Date of Completion: Indefinite.

Assignment: J. O. Stewart and administrative men assigned to Forests.

RG
Carrying Capacity,
General

Status: Since initiation of grazing reconnaissance in 1911, forage-acre data have been collected for approximately 26 million acres. Checks are being made by observations and use in actual grazing management of these estimates and adjustments made when necessary. On the average 0.8 forage acres per head per month are required for cattle, and .01 forage acres per head per day for sheep. Adjustments are made from these averages, however, in accordance with the influence of the factors affecting.

Since there is such a large variation in carrying capacity due to various factors entering it, surface acreage data obtained on one area is not usually applicable on another without taking into consideration these factors. It has come to be realized more and more that carrying capacity is a study of each individual area to determine the effect of the various factors entering in, or in other words, determination of forage acreage for each area adjusting the number of stock grazed to this figure and following this up by checks of actual use.

Specific observations were made on a number of cattle range pastures in District 3 in 1914, 1915, and since 1920.

Numerous check enclosures have been constructed on various Forests in all Districts, and in many instances quadrats established for use in direct ocular comparisons as well as detailed study to indicate the effect on present grazing use and adjustments needed.

Short articles have been published in various livestock journals and chapter included in Department Bulletin 790 on Range Management.

Further Work: The collection of data by grazing reconnaissance, special inspectors and local officers will be continued. Where practicable, additional special areas will be brought under close observations. Checks of results obtained by actual use will be continued. Special emphasis has been placed on more accurate observations on results of actual use in grazing administration by local officers. Observations and quadrat study of enclosures already constructed will be continued and additional check enclosures will be constructed in all the Districts as time and funds become available, and data secured by local officers and permittees will be reported.

Date of Completion: Indefinite. Carrying capacity will be a problem of importance for many years and therefore must be continuous. Specific studies may be completed and others initiated, but the main study will go on until the normal carrying capacity of all important grazing areas has been determined. This will require careful study followed by years of check by actual use. Therefore, it is a line of work hand in hand with actual grazing administration, supplemented by special studies here and there, rather than a specific study in any one locality.

Assignment: Inspectors of grazing, grazing examiners, and certain administrative men in each District under supervision of Washington and District offices.

RG
Carrying Capacity,
Spring-Fall Range
U.S.S.E.S.

Project: The carrying capacity of spring-fall range.

Scope: To determine the carrying capacity and forage-acre requirement of spring-fall sheep range under different methods of using the range and of handling the stock.

Status: Records are being maintained of the number of sheep and period grazed and degree of utilization at the end of the fall grazing season for the several paddocks, and by camps for the open range where sheep are herded. An intensive grazing reconnaissance was made in 1925. These records will be correlated to show surface and forage-acre requirement for sheep on spring-fall range. Special consideration will be given to effect of climatic conditions upon forage production.

Results: The average requirement for one sheep in the ten paddocks for thirty days was .60 acre per head in 1923, .64 acre per head in 1924, and .38 acre per head in 1925. The range was utilized a little closer in 1924 than in 1923, and about the same in 1925, as in 1924. The difference between 1924 and 1925 is credited almost entirely to more forage as the result of more favorable growing conditions in the latter year. These figures are tentative and for pasture handling which ordinarily gives a higher carrying capacity than under herd.

Plans: Grazing records will be maintained as in the past three years. At the first opportunity figures for the outside range will be worked up.

Assignment: C. L. Forsling, Great Basin Experiment Station, in cooperation with W. A. Denecke, U. S. Sheep Experiment Station.

RG

Carrying Capacity,
(Cooperation, Utah Agricultural College)

Object: To determine the proper dates between which the range may be grazed from the standpoint of the requirements of the forage plants and the demands of the stock, and the maximum number of stock the range can consistently support. Also the forage-acre requirements for cattle in the type of range studied.

Status: Enclosures and quadrats established on Cache Forest 1924.

Further Work: It is proposed that the Agricultural College will build suitable pastures on the Cache Forest and furnish the cattle to graze them under an agreed plan. Observations and records to be kept by Forest Service representative or jointly with the College.

Date of Completion: Indefinite.

Assignment: J. O. Stewart and Great Basin Experiment Station, in cooperation with Utah Agricultural College.

RG
Protection,
Grazing, Erosion
and Streamflow
G.B.E.S.

Project: The effect of grazing on vegetative cover in relation to erosion and streamflow.

Scope: To determine (1) the role of herbaceous and shrubby vegetation in the control of erosion and the regulation of streamflow, and (2) the regulation of grazing necessary to maintain adequate watershed protection.

Status: Two small watersheds designated as "A" and "B" at the head of Ephraim Canyon, the former with an area of 11.24 acres and the latter 8.97 acres, were selected and in 1915 equipped with devices to measure the amount and rate of fall of precipitation and run-off, and the material eroded. The vegetation on both areas originally had consisted principally of grasses and weeds with scattered clumps of wild currant (Ribes spp.) and Mountain elder (Sambucus sp.), with an occasional very small clump of timber, principally Alpine fir. Both areas had been badly depleted by overgrazing prior to 1912, and the herbaceous vegetation reduced to a poor stand, consisting largely of pentstemon (Pentstemon rydbergii), sweet sage (Artemisia ludoviciana), yarrow (Achillea lanulosa), and other species common to this association. The density of the vegetation on "A" was estimated to be .16 and that of "B" .4 at the beginning of the experiment. Dissimilarities other than in vegetative cover occur in topography and drainage system. Area "A" has a main drainage channel traversing the area from end to end with the terrain sloping with it from both sides, while "B" has a slope fairly uniform in direction. The mean gradient of "A" is about seventeen per cent, and that of "B" about fifteen per cent.

Both areas were closely grazed usually about the first of August each year by a band of sheep from 1915 to 1919, inclusive. The past five years "B" only has been grazed. Grazing was intended to be regulated to hold the density of the vegetation stationary during the periods each area was grazed. Area "A" has been allowed to improve the last five years. Records of amount and duration of precipitation, and amount of run-off and sediment have been obtained for each summer rainstorm since 1915, and for winter snowfall for several years.

Rainstorms in 1924 and 1925 have not been heavy enough to cause much more than a trace of run-off and sediment to be deposited in the catch tanks on either area. This is due to (1) mildness of rainstorms, and (2) revegetation of Area "A". Several storms that would have been sufficient to have caused rather heavy run-off on Area "A" prior to 1919 failed to cause

material run-off because of the improved plant cover. Nevertheless, this improvement has not been sufficient to prevent any floods occurring had the storm been more intensive.

As the result of the manner in which the two areas have been grazed, "A" has improved in density of vegetation from .16 in the beginning to .37 in 1923 and 1924, and "B" has remained stationary in this respect. Practically all of the improvement on "A" has occurred during the last five years. The records of precipitation and of streamflow and erosion show that this increase in vegetation has caused run-off to decline over 30%, and erosion to decline about 60% over the past five year period. In one storm in 1923 the reduction in run-off and sedimentation was over 66% each, as compared to a storm of similar intensity but of shorter duration in 1919.

Plans: A publication is in course of preparation. Records on run-off and erosion from melting snow will be obtained in the spring of 1926. Fall grazing will be carried out on Area "A" to plant seed and utilize forage. At present grazing of sheep is too late to utilize the grasses very closely. As the result there has been a decrease in the weed cover and a corresponding increase in grass. It may be found advisable to change to cattle on Area "B" in order to obtain better use of the grass. Other phases of project to be continued as heretofore.

Assignment: C. L. Forsling and E. W. Nelson, Great Basin Experiment Station.

RG
Protection,
Grazing, Erosion, and Stream Flow,
D-3

Project: The effect of grazing and vegetative cover on erosion and stream flow in the Southwest.

Object: To determine (1) the role of herbaceous and shrubby vegetation in the control of erosion and the regulation of streamflow; (2) the regulation of grazing necessary to maintain adequate watershed protection; and (3) the kind and extent of erosion on the Tonto watershed.

Status: The study of the utilization and management of browse range has shown conclusively that erosion is an extremely important problem, especially under the semi-desert conditions on the Roosevelt reservoir watershed. The deterioration of range in the last few years as a result of drought and overstocking has seriously impaired the effectiveness of the native vegetation in controlling erosion on the watershed.

General study has been made of the situation and certain enclosures established in order to afford an opportunity to determine the response of vegetation to total protection and different methods and intensities of grazing. The influence of vegetation on erosion under these different conditions is being studied in so far as the limited time and personnel are available.

Further Work: It is planned to make an erosion survey during the year and make a more careful study of the needs of more adequate research on the problem.

Assignment: C. K. Cooperrider, in cooperation with the Southwestern Forest Experiment Station and the local Forest, District and Washington offices.

RG
Erosion
Santa Rita

Project: To determine the rate of cutting in various types of soil as affected by (1) ground cover, (2) intensity of rainfall, and (3) slope, and to determine methods of prevention.

Status: The Reserve has not been confronted with any serious erosion problems, however, it is felt that some data along this line could be secured on the Reserve and particularly on adjacent public domain. The study was started with four plots laid out during the past summer. Lack of time to devote to the project prevented very much data being secured, however, the start made has suggested possible methods and conditions under which the project can be carried on.

Further Work: The study will be extended during the coming field season and a number of plots laid out both on the Reserve and adjacent public domain. It is not intended that the study will occupy a great deal of time just yet but at least it will suggest ways and means of conducting more extensive studies in this direction later on.

Date of Completion: Indefinite.

Assignment: Matt J. Culley, Santa Rita Range Reserve.

RG
Protection,
Planting to
Check Erosion
G.B.E.S.

Project: Planting to check erosion.

Scope: To determine ways and means and the practicability of planting of shrubs and herbaceous plants to check erosion along water courses and on denuded lands where abnormal erosion is taking place.

Status: Planting of various shrubs including aspen, willow, elderberry, and wild currant along washes and on denuded slopes failed as a measure to check erosion at the higher elevations. Terracing of denuded and eroded hillsides and planting to grasses and weeds including Bromus polyanthus, Hordeum nodosum, Agropyron violaceum, timothy, orchard grass, Kentucky bluegrass, smooth brome and sweet sage (Artemisia spp.) proved effective in checking run-off and arresting erosion. Native species are slowly working down the slopes below planting sites and reclaiming land beyond the bounds of the planted area. The cost of terracing and planting is so high, however, that this method is economical only when high values are involved or where a comparatively small amount of work will check spread of erosion over a wide area.

Native brome grass when sown broadcast over denuded slopes has taken hold in the gully bottoms, and when protected continues to spread. This method of planting appears to be the most effective, cost considered, in the checking of erosion and reclamation of slopes where erosion is in the "sheet" or "shoestring gully" stage.

Plans: Much work in this project remains to be done. However, it will not be undertaken actively until more time becomes available either through increase of funds or decrease in activity in other projects.

Assignment: C. L. Forsling, Great Basin Experiment Station.

RG
Protection,
Grazing and Reproduction.
D-2

Status: Two plots were established in yellow pine plantations at Halsey, Nebraska, in the horse pasture, to determine any influence which the grazing of the grass might have on the establishment and development of the yellow pine plants. Preliminary indications are that the seedlings have grown faster in the ungrazed part.

In cooperation with the Office of Forest Management, the Rocky Mountain Forest Experiment Station, and the Pike Forest, project was started on the Pike Forest in 1919 to determine the effect of cattle grazing on planted trees and erosion, and the possibility of overcoming erosion through planting or restricting grazing within the South Platte watershed. Two watersheds were fenced to exclude cattle, one being planted and the other unplanted. Two unfenced watersheds, one planted and the other unplanted, are also under observation.

At the close of the fifth season the average survival in the fenced plots is 40.9% while that of the unfenced plots is 48.3%. Smaller check plots put in in 1921 show 34% and 25% survival, respectively, for the fenced and unfenced areas.

Additional check plots of Douglas fir plantations showed 33% and 74% of the 1924 and 1925 planting living at the close of 1925 on grazed and 28% and 82% respectively on ungrazed plots.

Plots to study the effect of grazing on yellow pine reproduction have been established on representative areas of the main Forest types throughout the District, but it is too soon to attempt conclusions.

Further Work: On the Pike Forest survival counts of seedlings and chartings and observations on grazing quadrats and erosion points will be made every five years. Careful records will be made for the plots on all Forests.

Date of Completion: Indefinite.

Assignment: Administrative grazing officers of the District in cooperation with the offices of Forest Management, Rocky Mountain Forest Experiment Station, and the local Forest officers.

RG
Protection, Effect of
Grazing upon Reproduction
of Western Yellow Pine,
D-3

Status: Main study and supplementary study started in 1912. The main study completed in 1915 and report published as Bulletin No. 580 in December, 1917. During 1918 all plots on the Coconino Forest were re-examined and the stakes were re-established in cooperation with the Southwestern Forest Experiment Station.

Additional study by the Southwestern Forest Experiment Station and by reproduction surveys has resulted in the formulation of a District policy to eliminate sheep grazing from cut-over areas and those to be cut for a period just preceding cutting and extending after cutting until reproduction is established.

The plots will be re-examined periodically for the purpose of ascertaining the percentage of the reproduction originally on the plots when the study was started which eventually develops beyond injury by grazing, and to determine to what extent the new reproduction becomes established. It is possible that the study will need to be continued to find out if the desired amount of reproduction will come in eventually if grazing is continued and, if so, what delay has been occasioned by grazing and the effect of this delay upon the final mature stand of timber, either in quantity or time required to produce it. Therefore, the plots will be re-staked and re-examined as considered advisable by future developments.

Date of Completion: More in the nature of a line of work to secure proper management of stock to eliminate or lessen injury to reproduction.

RG

Protection, Effect of Goat Grazing upon Range, Timber Cover, Watershed, and Development of Improved Methods of Handling Goats

Status: The results of southwestern intensive investigations, except the effect of goat grazing upon reproduction and the general study on other Forest ranges, were published in Department Bulletin 749.

An interdepartmental cooperative bulletin on Angora Goats and Mohair has been projected and outline drafted.

Further Work: The application of improved methods of management should be extended on Forests and public domain by furnishing information through associations, individuals, and by demonstrations.

Date of Completion: The proposed work as outlined is in the nature of a line of work rather than a project. Consequently the studies will continue until satisfactory methods of management are adopted generally on Forest ranges.

Assignment: Forest officers administering goat ranges. W. R. Chapline to handle the cooperative bulletin.

RG

Handling Stock,
Improved Methods of Handling
Sheep on Forest Range

Status: Early work with coyote-proof enclosures on Wallowa Forest 1907 to 1910. Three circulars published on this. Observations on Lewis & Clark, Madison, and Lassen Forests in 1912; study by Grazing Examiner on the Madison Forest in 1913 and 1914; study by a special man on Payette 1912, 1913, and 1914; study by Grazing Examiner on Bighorn in 1913 and 1914. Observations and good results on Madison, Helena, Lewis & Clark 1915-1917. On Ochoco, Wallowa, Whitman, Rainier, Malheur, Wenatchee, Umatilla, California, Lassen, Fillmore, Fishlake, Manti, and Servier Forests, new method put into effect, one or two bands carefully studied. Since 1917 aggressive effort made to secure adoption of the bedding-out system on all Forests, and remarkable progress has been made. Deferred and rotation system of grazing being followed on many sheep ranges. General observations continued to determine difficulties and ways of overcoming them. Several articles published in National Wool Grower and a chapter in Department Bulletin 790.

Study of coyote-proof enclosures and sheds for lambing started in 1910 on Cochetopa. Forest Service Bulletin 97 published on this work. Considerable increase in lamb crop secured. The results have shown so conclusively to local ranchers the advisability of using similar enclosures and sheds that about 80% of the sheepmen using the Cochetopa ranges lamb with the use of sheds, and many of them have woven wire division pastures to aid in caring for the lambs during the lambing period. Several large sheep producers on the Datil Forest have adopted the improved methods, and improvements based upon the experiments have been adopted by many sheepmen.

Further Work: The bedding-out system of handling sheep has passed the experimental stage. Over 70% of all sheep on the National Forests are now handled according to methods approaching this system as advocated by the Forest Service. Continuous effort will be made to secure the adoption of this method by the remaining sheep owners, and to perfect a system of handling all sheep to more nearly approach the ideal desired. Additional demonstration tests under careful supervision may be necessary. Aggressive effort is being made to extend the use of the deferred and rotation system of grazing to all sheep ranges. Continued efforts will be exerted to secure application of better lambing methods.

Date of Completion: Continuous until satisfactory methods are adopted on all National Forests.

Assignment: Forest officers administering grazing under the general direction of District and Washington offices.

RG
Handling Stock
Improved Methods of
Handling Cattle on
Forest Range

Status: Observations have been made on a number of Forests to determine the best methods of management of cattle on the range, particularly to secure proper distribution of cattle on the ranges with reference to watering places, location of forage, and seasonal use of the range. Very favorable results have been obtained, especially on the Sierra, Whitman, Ochoco, Okanogan, and Uinta Forests, largely through proper salting, development of more watering places, and riding. For many Forests detailed salting plans have been developed, control fences and stock trails have been constructed, and permittees are giging their cattle more attention. On the Uinta and several other Forests in District 4, the time of grazing of different slopes and at different altitudes has been satisfactorily worked out through salting and riding. Salting plans are being developed for a large number of the Forests in all Districts but much still remains to be done before proper distribution of cattle on the range will be secured.

A study of salting practices was initiated in District 3 in 1921, and Department Circular 379 will shortly be issued covering this work as well as other salting methods throughout the west.

A study of all phases of handling cattle on rough, brushy ranges was initiated in 1920 on the Chiricahua Division of the Coronado Forest. Additional water developments, salting places, control fences, and cleared trails through the brush have been established. Detailed quadrat and general observations are being made at intervals.

Results of the early studies were incorporated in a chapter of U.S.D.A.Bulletin 790 on Range Management, and several articles published in the livestock journals.

Further Work: General observations of improved methods of handling will be made on many Forests and reports submitted. Greater effort will be made to secure wider application of methods already worked out on various kinds of range.

Date of Completion: Indefinite.

Assignment: W. R. Chapline, and Forest officers administering grazing under the general direction of District and Washington offices; M. W. Talbot (now of the Bureau of Plant Industry) until publication of circular.

RG
Handling Stock
Improvement in Grade,
Santa Rita

Project: To determine methods and factors influencing the improvement of the average grade of range stock in Southern Arizona.

Status: Considerable study has been devoted to this project in the past ten years with the result that the principal factors in improving the grade of stock have been determined. In brief these are: 1, use of purebred sires; 2, culling of undesirable and aged cows; 3, selection of heifers for replacing culled stock; 4, maintaining stock in good thrifty condition the year round; 5, prevention of inbreeding; 6, non-breeding of cows under two years of age; 7, proper salting of stock. A considerable amount of comparative data has been collected from sales records of outside stock and readily indicate the progress that has been made on the Reserve in the way of raising better stock.

During 1924 data on over 5,000 head of outside stock shipped from this vicinity were secured. In 1925 shipments were comparatively few and data on only 1400 head were secured. So far in 1926 data on about 1500 head of stock have been collected. Reserve sale records have been kept and compiled in detail for a number of years. A comparison of the figures shows that the Reserve stock brings from three to eight dollars more per head than outside stock of the same age. The cutbacks on Reserve stock run about 3 per cent while for open range stock the per cent is close to twenty-five.

Further Work: Study of all factors affecting this project will be continued and particular effort made to collect additional data for outside stock. During the coming field season it is planned to make an accurate check of all stock on the Reserve. Additional purchases of purebred bulls will be m de late this spring.

Date of Completion: Continuous.

Assignment: Matt J. Culley, Santa Rita Range Reserve.

RG
Handling Stock,
Improvements in Grade,
Jornada

Object: To improve the general grade of range stock through improved methods of breeding so that the cattle produced will develop better and approach more nearly to the color, conformation, and type of the beef breeds used, with the ultimate object in view of obtaining better prices for a product which is more uniform and supplies a better demand.

Status: On the Jornada Range Reserve purebred bulls only have been used since 1915. In that year a special herd of 500 selected cows and bulls were segregated from all other stock. The number in this herd was cut down as a result of the drought, and it was also re-selected in 1919. More recently both the special herd and the general herd on the Reserve were run together. Special effort was exerted in the culling of old and undesirable cows and in the selection of bulls and young heifers to replace cows. While drought affected the size to a certain extent, the results have shown in the improvement in steers from the Reserve, which have brought prices $2.50 to $5.00 more per head at various times than steers of the same age from herds on the outside range. Further, some yearling steers were of such quality that they sold along with 2-year-olds at 2-year-old prices. Results of the investigations have been published in chapters in Bulletins 588 and 1031. The top carload of calves weaned in 1923 from the Reserve weighed 465 pounds and sold as feeders for 6 cents per pound. Less a 5% shrinkage they brought $26.49 per head at the ranch. This compares with 50 carloads of steers from the same region, the majority of which were two's and up, which averaged approximately 579 pounds and sold for between 4 cents and 5 cents per pound or $26.78 per head. Fifteen carloads of weaned calves from the region averaged 322 pounds per head, 6 cents per pound, and $19.32 per head. This shows a difference in net price of but $7.46 per head in favor of the older steers, though the majority of them were cut 25% to eliminate undesirables. In the fall of 1924, 100 selected heifer and steer calves sold for $22.50 each.

The reasons for this have been largely the use of good purebred bulls, close culling of cows, careful selection of heifers, good feed, and the feeding of supplements when necessary.

Further Work: With restocking, project inactive during 1925 since all cattle were removed from the Reserve in the spring. The investigations will be continued, and still greater care will be exercised in the selection of bulls, culling of old animals, and the replacement by selected heifers.

Date of Completion: Continuous.

Assignment: J. D. Schoeller, Jornada Range Reserve.

RG
Handling Stock
Increase in Calf Crop
Santa Rita

Project: To increase the average calf crop on the ranges of southern Arizona.

Status: This project more than any other spells success or failure in the cattle industry. The calf crop represents the sole source of income to the stockman who is running a herd of breeding cows. The study has been going on for the past ten years on the Santa Rita and the following practices for increasing the calf crop have been found to be essential: 1. Keeping a sufficient number of active bulls on the range (on the Santa Rita four bulls to every hundred head of cows has proven sufficient. On rough ranges the number of bulls will necessarily have to be increased; 2. keeping of both bulls and breeding cows in thrifty condition yearlong; 3. culling impotent bulls and barren cows from the herd; 4. keeping bulls properly distributed over the range; 5. careful handling and constant supervision of stock; 6. culling aged breeding cows (above ten years); 7. proper salting of stock.

Results on the Reserve during the past ten years have been particularly encouraging with an average recorded calf crop of 73% as compared to an average of 55% on open unregulated ranges and approximately 60 % on National Forest ranges. The highest average among the cooperators on the Reserve is 79% for the entire period or 24 calves per hundred above that for outside ranges.

Further Work: Every effort will be made to further increase the annual calf crops and any additional factors that can be found will be carefully studied. Collection of data on outside ranges will be pushed as much as possible.

Date of Completion: Continuous.

Assignment: Matt J. Culley, Santa Rita Range Reserve.

RG
Handling Stock
Increase in Calf Crop
Jornada

Object: To determine the factors which influence the production of calves in the Southwest so that improved methods of management may be worked out which will result in increasing calf crops.

Status: Factors affecting calf crop have been carefully studied and the best principles applied in the practical management of the Jornada herds in so far as possible. The results have been a calf crop 15% to 25% greater than in other range cattle outfits on similar range. During drought years the calf crop has often been several times as large as some individual outfits experiencing similar drought conditions. On the Jornada Reserve the nine-year average of the general herd has been approximately 65%; while the special herd, with better care, has been nearly 76% for seven years. These averages include the effects of seven dry years. The largest calf crop so far received from the large special herd has been 88.8% in 1921.

These results have been secured largely because the cattle are provided with plenty of forage, water, and salt; sufficient bulls are used; adequate distribution of bulls is made; and more attention is given to potency and vigor, gentling cattle, age of breeding stock, separating breeding and non-breeding stock, and management in general.

A chapter outlining the early results was published in Bulletin No. 588, and the more recent results in Bulletin No. 1031.

Further Work: Careful observations and additional tests will continue to be made to determine more definitely the influence of the different factors affecting calf crop.

Date of Completion: Continuous.

Assignment: J. D. Schoeller, Jornada Range Reserve.

RG
Handling Stock
Management to Avoid Loss,
Santa Rita

Project: To decrease the average losses among range stock in southern Arizona.

Status: A great deal of data has been collected on this study which is probably next in importance to increasing the calf crop. Losses among range cattle constitute one of the most menacing liabilities of the industry and effective means of remedying the situation, now existant over most of the range country, is a vital factor in the future success of the business. During 1925 the best available estimates on unregulated ranges in this vicinity place the losses at not less than thirty per cent and were the truth really known they would probably run higher than this figure. The Reserve losses for the same period run under ten per cent including cooperators' stock which has been run on ranges adjacent to the Reserve proper. The average loss on the Reserve for the past eleven years, seven of which have been dry, has been about 3% or about one-third of the average loss on similar ranges of southern Arizona. The principal factors responsible for decreasing losses are as follows: 1. A strictly conservative use of the range so as to provide a safe surplus of feed in the average year. 2. Vaccinating against blackleg. 3. Prompt attention to injured or sick animals through constant supervision of herd. 4. Removal of stock from poisonous plant infested areas at the most critical seasons. 5. Guarding against losses from predatory animals. 6. Careful handling of stock. 7. Prevention of loss through straying by using fenced ranges.

In the spring of 1921 a large number of animals were saved from starvation by burning the spines off of cholla on the range.

Further Work: A more detailed study of this project is essential and will be undertaken this year along with the other handling stock projects.

Date of Completion: Indefinite.

Assignment: Matt J. Culley and Warren S. Turner, Santa Rita Range Reserve.

RG
Handling Stock,
Management to Avoid Loss,
Jornada

Object: To determine the best means of preventing losses caused by starvation, diseases and other causes which materially affect the cattle business in the Southwest, so that such limiting factors may be eliminated from the industry in so far as is possible.

Status: On the Jornada Reserve the minimizing of losses has resulted largely from providing sufficient feed, giving adequate care, and close culling of aged cows, vaccinating for blackleg, and giving such other attention to diseases as was practicable. Grazing on adjoining range has shown that attempts to hold old cows and to excessively use range seriously infested with loco are followed by serious losses when feed wanes.

In 1922 the Jornada Range Reserve in southern New Mexico experienced the worst drought and greatest shortage of feed so far experienced since 1915 when the Forest Service took over the investigations. Over 650,000 cattle were moved from New Mexico during the year, and all cattle had to be moved from many southern New Mexico ranges. The 4.4% loss on the Jornada in 1922 from all causes exceeded the 3.5% loss suffered during the drought of 1918, but that loss compares with losses on other similar ranges of 25% to 35% and in some cases even higher. The loss was prevented from being greater by reserving some range forage for the critical period of the year, supplemental feeding of cottonseed cake, early weaning, and removal of calves, and the keeping of the number of stock on the range as near the actual carrying capacity as was practicable. The management of the Reserve has been placed on the basis of where 50% of the number of stock which may be carried in good years is carried as breeding stock, which may be held over the drought with only careful culling. The balance of the carrying capacity in good years will be used by steers or other stock which can be disposed of readily when drought conditions threaten or actually decrease the volume of feed available. Losses have been kept down in all years by the feeding of cottonseed cake during the winter and spring of poor cows, bulls, and many calves.

During the drought of 1917-18 the grinding of soapweed was placed on a practical scale and more than 1,000 poor cows were fed soapweed and cottonseed products on the Jornada Reserve, saving probably 500 head from starvation. Department Bulletin 745, giving the results of this work, was published. Soapweed also proved satisfactory as ensilage, while Tobosa grass did not.

The results of the work on the Jornada Reserve were published in Bulletin 528, and more recent results in a chapter in Bulletin No. 1031.

The most striking results are that the average loss on the Jornada for ten years, including seven dry ones, has averaged 1.6% or about one-fifth of the average loss on similar ranges of southern New Mexico.

Farmers' Bulletin 1428 on saving livestock from starvation on southwestern ranges, by C. L. Forsling, was published in 1924.

Further Work: It is planned to continue the investigations along the above lines. Work will be intensified as far as seems practicable under management on large range units.

Date of Completion: Continuous.

Assignment: J. D. Schoeller, R. S. Campbell and Roy Canfield, Jornada Range Reserve.

RG
Handling Stock
Salting
Santa Rita

Project: This project has for its objects the following:

1. A determination of the most effective placing of salt on the range with relation to water.

2. A determination of the loss of various kinds of salt due to weathering.

3. A determination of the relative merits of various kinds of salt.

4. A determination of the relative palatability of various kinds of salt.

5. A determination of the amount of salt necessary per head per year.

Status: 1. This phase of the salting project has been given considerable study and a fairly definite salting plan established for the Reserve. Salting is practiced both at and away from water and no disadvantageous effects, so far as the stock are concerned, have been noted from the latter practice. Whether salt should be placed at or away from water must be decided for each range in question. Control of stock so as to effect seasonal use of certain areas has been very effectively secured through the placing of salt on parts of the range where use was desired. Salt as far out as two and a half miles from water has been fully utilized and has resulted in materially better use of the range. The problem of salting near temporary water, put out by rain, during the summer has proved an important consideration.

2. Loss of salt through weathering and using various kinds of containers is a new project started in a small way during the past summer. Briefly, the results so far indicate that there is no great difference in weathering loss between different kinds of block or rock salt. Compressed white block salt showed the least loss with sulphur block and common rock salt following in the order named. As to the kind of container used, the study showed very clearly that a tight box would greatly increase the loss while a box that permitted water to drain off would result in the least loss of all.

3 and 4. New subprojects and no work yet done.

5. Some data has been secured on the yearlong requirements of stock but not sufficient to warrant any different conclusions than have been drawn elsewhere. But little data has been secured for variation in seasonal requirements of stock.

Further Work: Subprojects 1, 2 and 5 will be stressed in future study of the salting problem, while subprojects 3 and 4 will be carried out if conditions permit.

Date of Completion: Continuous.

Assignment: Matt J. Culley, Santa Rita Range Reserve.

RG
Handling Stock,
Cost of Production,
Santa Rita

Project: To determine the chief factors entering into the cost of production of range stock.

Status: While material progress has been made in this study there still remains a great deal of data to assemble for the Reserve and also for outside ranges. The problem of securing data for the latter has presented difficulties in the form of lack of time for collection and more or less question of the figures when collected. Such figures as have been worked up very clearly indicate the advantages to be gained through efficient handling of stock on a fenced range as compared to the unregulated system generally practiced on public domain. While the total investment on the fenced range considered was almost 40% greater than that of the unfenced range the former operation showed a net profit of 7.4% while the latter resulted in a loss of 5.8% on the total investment.

Further Work: Further data will be collected for outside operations and complete data for the Reserve worked up as soon as possible.

Date of Completion: Continuous.

Assignment: Matt J. Culley, Santa Rita Range Reserve.

RG
Handling Stock,
Costs
Jornada

Project: To determine the relative cost of producing cattle under pasture and improved methods of management as compared with the cost on open range.

Status: The analysis of the record of cost of operation on the Jornada Range Reserve for ten years show that with values as nearly as they can be determined at the present time it costs approximately $9.91 a year to carry each cow, which makes a short yearling cost $15.99 without interest when the calves raised number 62 per hundred cows. With interest, the cost per head for the same number raised is $21.68.

Further Work: Careful records will be kept as to the cost of different phases of producing cattle on the Jornada. Similar data will be collected as far as practicable for outside range conditions.

Date of Completion: Continuous.

Assignment: J. D. Schoeller, Jornada Range Reserve.

RG
Handling Stock
Herding vs. Pasture
Spring-Fall Range
U.S.S.E.S. & G.B.E.S.

Project: Herding vs. the pasture method of handling sheep.

Object: To compare the carrying capacity and relative cost of handling sheep in pastures as compared to herding on spring-fall range.

Status: Nothing has been done on this project to date except to obtain data for grazing of the ten sheep paddocks. As soon as feasible it is planned to fence sheep tight, the area south of the Camas-Meadows road, where a small band of sheep may be grazed under the pasture method for comparison with the open herding method.

Assignment: C. L. Forsling, Great Basin Expt. Sta., in cooperation with W. A. Dennecke, U. S. Sheep Expt. Sta.

RG
Poisonous Plants

Project: Eradication of poisonous and unpalatable plants from the range.

Status: Eradication of tall larkspur by grubbing has passed beyond the experimental stage and has been extensively done on a great many Forests in Districts 1, 2, 4, 5, and 6. Up to and including 1922 larkspur had been eradicated from a total of over 7,250 acres, at an average cost of less than $5.50 per acre. An additional 8,300 acres where larkspur was in small amount have been cleared at about 20 cents per acre. The total cost of larkspur eradication through 1922 has been $38,267, over one-half of which was paid by interested stockmen. The estimated annual reduction in loss of stock as a result of this work has been over $65,000. With few exceptions, the value of the stock saved as a result of the eradication work has been sufficient in one year to cover from one-third to two times the cost of eradication. Report on eradication of tall larkspur by grubbing published in Farmers' Bulletin 826, 1917. This will be revised and brought up to date in the near future.

At the Great Basin Experiment Station studies on an experimental basis showed that cutting above ground four times during a period of three years is the cheapest way of eradicating tall larkspur on areas relatively free from rock, brush, and timber. This method should be tried out on a practical basis to secure a comparison of costs with effectiveness of grubbing before the cutting method is finally advocated for use under practical range conditions. Tests were made with a number of chemicals in 1924.

A small area of tall larkspur on Madison Forest in Montana was mowed in 1925 with a view to testing eradication by this method.

On the Deschutes Forest in Oregon experimental eradication of water hemlock at an initial cost of $4.83 per acre with minor amount of eradication in following years gave better distribution of stock and eliminated an annual loss of cattle greater than the total cost of eradication.

Studies have been made in District 3 of the possibilities of eradicating loco by grubbing and of reduction of losses from loco poisoning by change in the method of range management and the time of grazing. On several areas, eradication has been 90% to 95% effective and apparently has proven practicable from an economic standpoint. Results in grubbing loco on the Pike Forest show no advantage in grubbing at any particular time of the year, and that a single grubbing is ineffective and re-grubbing for several years to eliminate new seedlings is necessary if any benefit is to be secured from grubbing.

An additional study has been devoted to eradicating death camas and sneeze weed.

Further Work: Eradication of tall larkspur by grubbing will be continued as a range management project in cooperation with stockmen, as fast as funds are available until losses of livestock from this cause within practical possibilities has been eliminated. As soon as it is feasible to do so, a practical demonstration of eradication of tall larkspur by cutting, in accordance with plans developed by the Great Basin Experiment Station, will be undertaken. A study of methods for eradicating low larkspur will probably be undertaken in District 1 this year.

When time permits a thorough test of all possible methods of eradicating loco and Isocoma will be made on the Santa Rita Range Reserve.

Observations on eradication of other poisonous plants and management of areas infested will be continued and if the conclusions appear to warrant it, further investigations will be initiated as soon as funds and men are available.

Date of Completion: No further investigations as to methods, cost, etc., will be done with grubbing tall larkspur, since it is believed that methods are sufficiently standardized to obviate the necessity for further special study. Work on other poisonous plants will continue as men and funds are available until satisfactory means for controlling the poisonous plants on Forest ranges have been worked out.

Assignment: W. G. McGinnies, District 1; C. L. Forsling, Great Basin Experiment Station; Matt J. Culley, Santa Rita Range Reserve; and Forest officers administering grazing under the general direction of District and Washington offices.

RG
Water Development

Project: Number, distribution, and cost of watering places on cattle ranges of the Southwest.

Status: Farmers' Bulletin No. 592 was published in 1914 as a result of the general study of possibilities of water development on all National Forests.

In District 3 observations of water distribution and methods of developing water on the National Forest ranges were made over a period of three years with a view to formulating effective methods of water development and effective distribution of watering places to secure maximum utilization of the range consistent with the difficulty and cost of water development. Department Bulletin 1358, "Range Watering Places in the Southwest," by Mr. M. W. Talbot was issued during the year.

During the past ten years careful studies have been made at the Jornada and Santa Rita Range Reserves to determine the distance that permanent watering places can be apart and still secure reasonably efficient utilization of the range. To supplement such existing permanent watering places numerous small tanks have been constructed at the Jornada Reserve, and one such on the Santa Rita.

It is found that where conditions are favorable to the construction of tanks for accumulation of water to be used during a portion of the year to supplement more permanent supplies, the money spent for such water development is a good investment. This supplemental water results in better distribution of the stock, more equal utilization of the range, more succulent feed, less waste of energy in travel by the stock, and the possible protection of range around permanent waters for use during critical periods when the temporary watering places go dry.

Further Work: The investigations at the Jornada and Santa Rita Reserves will be continued to determine the influence of the factors affecting water development and its true value in range management. Methods of developing water and costs, especially of tank construction, will be further observed. The observations on National Forest ranges will be continued.

Date of Completion: Indefinite.

Assignment: Matt J. Culley, Santa Rita Range Reserve; J. D. Schoeller, Jornada Range Reserve.

RG

Range-Destroying Rodents
(Cooperation, U. S. Biological Survey)
Jornada

Status: The kangaroo rat eradication work on the Jornada has been handled entirely by the U. S. Biological Survey under the direction of R. H. Miller, Junior Biologist.

A crew of five men on horseback covered 78,000 acres in approximately fifty days at a cost of $.0193 per acre. It was estimated that a total of 204,211 rats were exterminated, averaging 3.21 rats per acre, the cost per rat being $.0073. Several formulas for poisoning the grain were used, but the most effective and economical one was found to be a 1 to 30 mixture of Strychnine (standard formula) used on steam-rolled oats.

The type of range most generally covered in this work was black grama, although considerable of the mixed grass type and sand-hill type were also covered. Both the grama and mixed grass types as well as the sand-hill type on the Reserve seem to be the most favored haunt of the kangaroo rat, probably because of the character of both soil and grass which is apparently well suited to their habits.

Three species of rats were found to exist on the Jornada: (Dipodomys spectabilis, D. marrimai, and D. ordii). Two of these live by means of harvesting and storing up both seed and grass, the third lives by robbing the other two.

The kangaroo rat not only reduces the carrying capacity of a range by consuming and storing seed and grass, but causes the potential carrying capacity to be reduced by devastating and the denuding of the area around his den which is a factor in hastening the ultimate destruction of a range, particularly when it is being constantly overgrazed, as is the case on much of the public domain.

On the Jornada it was estimated that the kangaroo rats reduced the annual carrying capacity of the area covered by eradication fully 6% and a further reduction of 1/2 per cent has taken place by a reduction in the area capable of producing forage. In the past nine years Pasture No. 2 has carried an average number of 613 head of stock yearlong, equivalent to 60 acres per head. Having this as a basis, since this pasture is typical of the 78,000 acres poisoned, the value of the carrying capacity on the area covered has amounted to $241.00 per year figuring grazing at $1.50 per head. This means that over the past nine years the carrying capacity has been cut approximately 161 head yearly or equivalent to the loss of a pasture containing approximately 9700 acres.

The work already done, however, will not assure the Jornada of the increased carrying capacity in the future of 161 head because there remains a considerable remnant of the rats which are increasing as time goes on, and unless the area is covered again it will not be long before the same conditions will exist as in the past.

Further Work: Careful observations will be made of the recovery of the affected range, and further damage from the remaining rats.

Assignment: J. D. Schoeller, Jornada Range Reserve, in cooperation with Biological Survey.

RG

Utilization and Management of Bunchgrass Range

Project: Utilization and management of bunchgrass range in the Southwest.

Object: To determine the carrying capacity, proper time of grazing, revegetation requirements, and methods of handling stock on bunchgrass range.

Status: There are extensive areas of coarse bunchgrasses, largely Festuca arizonica and Muhlenbergia gracilis in the Forests of the Southwest of which the true grazing value is not known. These grasses usually attain rank growth and are tender and highly palatable in the spring, becoming somewhat dry and coarse later in the season as the seed crop matures. When green they furnish excellent feed, but as they mature there appears to be a corresponding decrease in palatability and it is evident that the completeness with which they can be utilized without decrease in gain of stock and possible injury to the range itself is not as great as for many other grass species. The problem is to determine what is proper utilization from the standpoint of both stock and range, and consequently the true carrying capacity and methods of handling stock and range to secure this use.

Observations were made on three pastures on the Apache Forest in 1914 and 1915 and report submitted. General observations have been made on the Coconino and other Forests. An examination was made on the Apache in 1920. Valuable data as to the value of the bunchgrass range for cattle has been secured but results are by no means conclusive.

Further Work: Through the assistance of the District office active work will be undertaken this year.

Date of Completion: The study will continue until point of satisfactory utilization of bunchgrass is determined and improvements planned that will secure this utilization.

Assignment: C. K. Cooperrider, R. F. Copple, and local Forest officers in District 3.

RG
Management of Browse Range
G.B.E.S.

Project: The management of browse range.

Object: To determine for the browse type of range (1) adaptability of use by cattle, (2) carrying capacity, (3) period of use, (4) requirements for natural revegetation, (5) value as protection for watersheds, and (6) standards of utilization.

Status: A group of cattle have been grazed during the summer season for 5 years on a selected area of browse range where Gambel oak constitutes 30.1 per cent of the total vegetation, serviceberry (A. rubescens) 18.2 per cent, birchleaf mahogany 12.1 per cent, sagebrush 10.9 per cent, various other shrubs 15.1 per cent, and weeds and grasses 13.6 per cent. Stocking has been on a basis which would force the stock to subsist on a browse ration for the majority of their feed. Animals have been weighed at frequent intervals and notes on utilization, calf crop, etc., obtained each year.

Five years grazing shows that use on the above basis:

(1) Affords but little more than a maintenance ration for dry stock after the herbaceous vegetation and more palatable browse has been utilized and that cows with calves are likely to lose in weight. During the early part of the season, however, when the herbaceous feed and more palatable browse is available, the stock made good gains. Growth of range stock older than calves is so slow that they do not appear to be very profitable. Only a small percentage of the cows with calves attain a condition to breed each year, so that the average annual calf crop is below 50 per cent. Many calves are dropped at the wrong time of the year.

(2) That securing fair use of the less palatable browse species such as oak will result in injury and probably eventual killing out of the palatable herbaceous species and more palatable browse plants. Forced use of oak may result in killing out of this species.

(3) On steep slopes or on compact soil, use on the basis of the oak forage is very likely to result in serious erosion.

Browse range of the character used in the experiment appears to be best adapted for spring and fall use, although where no better summer range is available it may be used, but not to the best advantage, as

summer range. When used as summer range it should be stocked on the basis of the palatable herbaceous vegetation and the more palatable browse plants, together with that portion of the oak which will be taken incident to the better forage. Such use, it is believed, will result in a fair carrying capacity, perpetuation of the more valuable forage species and adequate watershed protection. It is believed that running a breeding herd and producing calves for fall market will be the most profitable class of operation on this type of range. This is providing adequate care is taken of the breeding cows in the winter, so that they will be in a condition to take advantage of the best feed and make gains to attain a condition for breeding during the early part of the season each year.

Plans: A report for publication is in course of preparation. The project will be rested during the season of 1926, and only records of growth will be obtained during that season. This will place the area in a condition to go ahead with ascertaining true carrying capacity, palatability of browse species, and other plans of the study in 1927 or later.

Assignment: C. L. Forsling and E. W. Nelson, Great Basin Experiment Station, and E. V. Storm.

RG
Utilization and Management of
Browse Range
D-3

Object: To determine the proper management of southwestern browse range involving (1) suitability of use, (2) class of stock to which adapted, (3) carrying capacity, (4) grazing period, (5) requirements for revegetation, (6) effect of grazing on erosion and timber reproduction, and (7) standards of utilization.

Status: There are extensive areas of browse range throughout the Southwest which have generally been overgrazed for many years. Three one-acre areas on representative but overgrazed browse types on the Tonto Forest were fenced in 1920 as a part of the Natural Revegetation project. Quadrats were established and typical browse plants tagged. Records were taken in 1920, 1921, and 1924. Several experimental cattle allotments on the Tonto and one on the Crook Forest were placed under intensive observation during 1924. The following tentative indications are shown:

1. Owing to the maintenance ration ability of browse ranges and the overstocking that this has made possible, the average browse range in any given region has through long years of accumulative effect decreased in actual feed production to but a small percentage of its original capacity. This same average range is expected today to carry from one-half to three times as many stock as it will carry in its present state and perpetuate itself.

2. The effect of this condition is a gradual approach to a state where operation and control costs render the business an economic impossibility for cattle breeding, either at present stocking or on a recovery basis, to say nothing of the effect on watersheds. The general nearness of approach to this state is reflected in unprecedented failure of the cattle-breeding industry in these regions.

3. The browse-woodland range made up of a combination of browse, grass and weeds is the most productive of our browse ranges. Used in connection with grass range, it is an excellent insurance and a good seasonal range if not abused. Used in a manner that perpetuates the short herbaceous vegetation within and between the brush fields, the type is one of our best soil formers, therefore, one of the best covers from a watershed standpoint.

4. Where herbaceous perennials form or are capable of forming any appreciable percentage of the forage supply on semi-desert range any kind of grazing use or range management that obliterates or tends to destroy these perennials (grasses and weeds) is overgrazing regardless of the use of the browse species.

5. Overgrazing results in erosion in the grass portions of the type with increased erosion, started in the first instance, on the annual-browse portion of the area, converting the semi-desert into one of the less productive desert types by a loss of the basic resource soil. A vast acreage of semi-desert range in the Southwest is being converted into unproductive desert through soil removal. Grasses, particularly those with stolons, if allowed to become established, play an important role in retarding erosion.

6. On browse-annual desert range annuals are a very uncertain quantity. Several growths may take place during the year; however, a growth or combined yearly growth of merit is the exception, not the rule. Annual growth, even limited, however, marks a period of recuperation from maintenance or starvation stages in condition of cattle.

7. Desert range of this type on which mesquite, catclaw, and other related species are dominant if fully stocked probably furnishes fair feed to the extent young growth (leaves, green twigs and beans) remain succulent, after which period maintenance stages decline to starvation unless relieved by productive weather and substantial growth of annual weeds and grasses.

8. Variations in vegetative cover ranging from desert through semi-desert to brush woodland depends more today on soil than on elevation or other factors affecting climatic habitat.

9. Curley mesquite (Hilaria berlanger) increased as much as 215 per cent in density under protection from grazing in four years. On a steep slope the increase was 127 per cent. With good growing conditions increase in density is rapid through extension by stolons. Under excessive overgrazing with drought the density decreases very rapidly.

10. Hairy Grama (Bouteloua hirsuta) increased under protection in spite of severe drought conditions but decreased under drought and overgrazing.

11. All browse species showed good growth under protection even during drought and in most instances showed recovery from the former severe grazing.

Further Work: The investigations will be continued on the Tonto and Crook Forests.

Date of Completion: Main work about 1927 or 1928.

Assignment: C. K. Cooperrider and R. F. Copple.

RG

Grazing Management of Cut-over Areas,
D-6

Object: The object of this project is to determine the essentials for the formulation of the constructive grazing practice which will insure for logged-over lands in the Pacific Northwest (1) adequate reforestation, (2) maximum reduction of fire hazard through grazing use, (3) profitable returns from grazing.

Status: Considerable data now of record relating principally to the grazing practice of a number of the larger logging concerns. Study of all phases with two bands of sheep on Columbia Forest in 1925. Subprojects on Crater, Siskiyou and Wenatchee initiated. Inspection of cut-over region in Columbia and Clatsop Counties, Oregon, made with interested Oregon Agricultural College authorities.

Further Work: Will be conducted along somewhat similar lines. Emphasis will be given during the year to such economic phases as (a) gains in weight made, (b) cost of handling, (c) losses, (d) rental values, (e) railroad rates, (f) carrying capacity, (g) fire insurance, (h) reduction in hazard, etc.

Date of Completion: The economic phases will probably be completed in 1927, the other phases including final effect on forest regeneration, indefinite.

Assignment: D. C. Ingram, in cooperation with the Northwest Forest Experiment Station, Oregon Agricultural College Experiment Station, the Office of Forest Management; technical Forest officers assigned to the Wenatchee, Crater and Siskiyou.

RG
Cooperation,
Montana Agricultural College Experiment Station,
(Range Sheep Management)

Object: To study management of sheep on National Forest ranges correlated with winter feeding and other yearly operations.

Status: The Montana Experiment Station began grazing the Station herd of sheep during the summer period on a selected allotment of the Gallatin National Forest in 1925. The sheep are wintered in the Gallatin Valley. The Forest Service will make an intensive management plan by grazing reconnaissance for the allotment and will keep a record of the range phases of the project. The Experiment Station will handle the animal husbandry phases.

Further Work: A better range allotment will be furnished the station for their herd in 1926.

Date of Completion: Indefinite.

Assignment: W. G. McGinnies in cooperation with Montana Agricultural College Experiment Station.

RG

Cooperation,
U. S. Range Livestock Experiment Station

Object: To assist in the range investigative work to be undertaken at the Experiment Station.

Status: The area was covered by intensive reconnaissance by members of the Forest Service in 1924. A general period study was made on the range in 1925.

Further Work: Further cooperation is dependent on the funds available. It is impossible for the Forest Service to actually cooperate at the present time.

Date of Completion: Indefinite.

Assignment: Forest officers of District 1 in cooperation with Bureau of Animal Industry and other cooperating organizations.

RG

Exhibits and Publicity

Project: Cooperation in extension, the preparation of exhibits and illustrative material for educational purposes, motion pictures, etc., and the dissemination of results by other means.

Object: To disseminate information relative to principles developed in range investigations in a more popular and effective manner than is had with Department Bulletins and formal reports.

Status: Beginning in 1918 lantern slides, charts illustrated in natural color, wall charts, lectures, popular articles, and fair exhibits have been prepared on the work at the Great Basin Station. This material has been used in lectures before livestock meetings and college students, at fairs, and published in various periodicals throughout the western Districts.

For several years certain exhibits have been prepared illustrating improved principles of range management, especially for the Pacific International Livestock Exposition at Portland, Oregon, the International Livestock Exposition at Chicago, and several State Fairs. In 1924 the Forest Service took an active part in developing the Department Exhibit on Range and Livestock management for use on the Western Fair Circuit. An exhibit illustrating deferred and rotation grazing and a model showing the effect of erosion was prepared by Public Relations of D-4 in collaboration with the Great Basin Station. An exhibit illustrating erosion and its effects is in course of preparation by the Office of Exhibits of the Department.

A general range management lantern slide lecture was also prepared on "Range Management on the National Forests" and several have been prepared by the District offices.

Cooperation has been extended to the Office of Motion Pictures in connection with the preparation of livestock motion pictures.

During 1924 and 1925 field demonstrations lasting two days each were held at the Great Basin Station, and each was attended respectively by an aggregate of 125 and 150 stockmen, Forest officers, and other interested parties.

In February the District 3 Supervisors held a meeting at the Santa Rita Range Reserve and in October a field day was held attended by over fifty representatives of the stock industry, State Experiment Stations, financial interests and the Forest Service. The County Agents of New Mexico visited the Jornada Reserve.

Members of the Forest Service attended the extension conferences in a number of western States and assisted in developing the State Extension programs.

Further Work: Effort will be made, in cooperation with Public Relations and the Office of Exhibits and other interested organizations, to work up exhibits for use at the State and other Fairs, livestock expositions, and meetings. Additional lantern slide lectures covering specific phases of range management will be prepared. Greater effort will be exerted to get results of investigations before the public as news items and other short notes.

Date of Completion: Continuous.

Assignment: Great Basin Experiment Station, Range Reserves, special investigative men, District and Washington offices of Grazing in cooperation with Branch of Public Relations in Forest Service, Extension Service in the Department, and other interested agencies.

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_____ 1911. Coyote-proof enclosures in connection with range lambing grounds. For. Ser. Bul. 97.

_____ 1915. Improvement and management of native pastures in the West. Y.B. Sep. 678.

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See also Barnes and Jardine, and Office of Grazing Studies.

Malmsten, H. E. See Sampson and Malmsten.

Office of Grazing

1914. Notes on National Forest range plants, 1: Grasses.

1925. Instructions for National Forest range plant work.

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_____ 1909. Natural revegetation of depleted mountain grazing lands. For. Ser. Circ. 169.

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_____ 1913. Range improvement by deferred and rotation grazing. Dept. Bul. 34.

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